A Dissertation On

"A COMPARATIVE STUDY OF LOCAL AND SPECIFIC ACUPUNCTURE POINTS ON PERIARTHRITIS OF SHOULDER"

Submitted by

Dr.A.NAVEENA, B.N.Y.S (Reg. No. 461413002)

Under the Guidance of

Prof. Dr. R. S. HIMESHWARI, N.D. (OSM), MSc (Yoga), D.M.T, D.Ac

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Date: 5/10/17

Place: Chennai

SIGNATURE OF THE GUIDE

Dr. R. S. HIMESHWARI, N.D. (OSM), MSc (Yoga), D.M.T, D.Ac

Head of Acupuncture & Energy Medicine Department,

Government Yoga and Naturopathy Medical College &

Hospital, Arumbakkam, Chennai – 600 106.

GOVERNMENT YOGA AND NATUROPATHY MEDICAL COLLEGE & HOSPITAL, ARUMBAKKAM, CHENNAI.

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I certify that the dissertation entitled **"A COMPARATIVE STUDY OF LOCAL AND SPECIFIC ACUPUNCTURE POINTS ON PERIARTHRITIS OF SHOULDER"** is the record of original research work carried out by **Dr.A.NAVEENA,** in the Department of Acupuncture & Energy Medicine, Government Yoga & Naturopathy Medical College & Hospital, Chennai – 600 106 submitted for the degree of **DOCTOR OF MEDICINE (M.D) IN ACUPUNCTURE & ENERGY MEDICINE** under my guidance and supervision, and that this work has not formed the basis for the award of any degree, associateship, fellowship or other titles in this University or any other University or Institution of higher learning.

Date: 5/10/17

Place: Chennai

SIGNATURE OF THE HOD

Dr. R. S. HIMESHWARI, N.D. (OSM), MSc (Yoga), D.M.T, D.Ac
Head of Acupuncture & Energy Medicine Department,
Government Yoga and Naturopathy Medical College &
Hospital, Arumbakkam, Chennai – 600 106.

GOVERNMENT YOGA AND NATUROPATHY MEDICAL COLLEGE& HOSPITAL, ARUMBAKKAM, CHENNAI.

ENDORSEMENT BY THE PRINCIPAL

I certify that the dissertation entitled **"A COMPARATIVE STUDY OF LOCAL AND SPECIFIC ACUPUNCTURE POINTS ON PERIARTHRITIS OF SHOULDER"** is the record of original research work carried out by **Dr.A.NAVEENA,** in the Department of Acupuncture & Energy Medicine, Government Yoga & Naturopathy Medical College & Hospital, Chennai – 600 106 submitted for the degree of **DOCTOR OF MEDICINE (M.D) IN ACUPUNCTURE & ENERGY MEDICINE** under my guidance and supervision, and that this work has not formed the basis for the award of any degree, associateship, fellowship or other titles in this University or any other University or Institution of higher learning.

Date:

Place: Chennai

SIGNATURE OF THE PRINCIPAL

Dr. N. MANAVALAN, N.D. (OSM), M. A (G.T), M.Sc(Y&N), M.Phil, P.G.D.Y, P.G.D.H.M, P.G.D.H.H,

Government Yoga and Naturopathy Medical College & Hospital,

Arumbakkam, Chennai – 600 106.

GOVERNMENT YOGA AND NATUROPATHY MEDICAL COLLEGE & HOSPITAL, ARUMBAKKAM, CHENNAI.

DECLARATION BY THE CANDIDATE

I, **Dr. A.NAVEENA** solemnly declare that dissertation titled **"A COMPARATIVE STUDY OF LOCAL AND SPECIFIC ACUPUNCTURE POINTS ON PERIARTHRITIS OF SHOULDER"** is a bonafide and genuine research work carried out by me at Government Yoga & Naturopathy Medical College & Hospital, Chennai from July 2016 – June 2017 under the guidance and supervision of **Dr.R.S.HIMESHWARI,** HOD, Department of Acupuncture and Energy Medicine, Govt. Yoga & Naturopathy Medical College & Hospital, Chennai. This dissertation is submitted to The Tamilnadu Dr. M.G.R. Medical University towards partial fulfillment of requirement for the award of M.D. Degree (Branch – III) in Acupuncture & Energy Medicine.

Date: 5/10/17

Place: Chennai

Signature of the Candidate

(Dr.A.NAVEENA)

INSTITUTIONAL ETHICAL COMMITTEE

GOVERNMENT YOGA AND NATUROPATHY MEDICAL COLLEGE &HOSPITAL, ARUMBAKKAM, CHENNAI – 600 106.

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Date: 5/10/17

Place: Chennai

A.Naveenee

Signature of the Candidate

(Dr.A.NAVEENA)

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Date: 5/10/17

Dr.Naveena

Signature of the Candidate

Place: Chennai

(Dr.A.NAVEENA)

LIST OF ABBREVIATIONS

ANS	Autonomic Nervous System	**MMP**	Matrix Metalloproteinase
aROM	Active Range of Motion	**MPQ**	McGill Pain Questionnaire
ANOVA	Analysis of Variance	**NSAIDs**	Non-Steroidal Anti-Inflammatory Drugs
AMPA	a-Amino-3-Hydroxy-5-Methyl-4-Isoxazolepropionic Acid	**NMDA**	N-Methyl-D-Aspartic Acid
CMS	Constant-Murley Score	***p***	Probability
CV	Conception Vessel	**PAS**	Periarthritis of Shoulder
CFA	Complete Freund's Adjuvant	**ROM**	Range of Motion
DM	Diabetes Mellitus	**SD**	Standard Deviation
DNIC	Diffuse Noxious Inhibitory Control	**SPG**	Specific Points Group
EA	Electro Acupuncture	**SPSS**	Statistical Package for the Social Sciences
GB	Gall Bladder	**ST**	Stomach
ILs	Interleukins	**SI**	Small Intestine
KI	Kidney	**SPADI**	Shoulder Pain and its Disability Index
LTP	Long-Term Potentiation	**TW**	Triple Warmer
LTD	Long-Term Depression	**TNF**	Tumor Necrosis Factor
LPG	Local Points Group	**TGF-beta**	Transforming Growth Factor beta
LI	Large Intestine	**UB**	Urinary Bladder
5-HT	5-Hydroxytryptamine	**VAS**	Visual Analog Scale

ABSTRACT

Background: Periarthritis of shoulder (PAS) is a common painful condition of shoulder, which affecting 2% - 3% in general population and 20% in diabetic patients. Acupuncture is a traditional Chinese medicine, recent evidences shows it alleviate the shoulder pain on different needling techniques. Present study is to compare the efficacy of specific (distal) and local *(ashi)* points on PAS patients with pain and its range of motion.

Methods: Sixty subjects mean aged (53.88 ± 7.64) were randomly assigned into specific points group (SPG, n=30) and local points group (LPG, n=30). Both groups were assessed at baseline and at the end of 12 sessions for Shoulder pain and its disability index (SPADI) and the range of motion (ROM). Intervention was weekly thrice on alternate days for four weeks. Sterile needles were placed on the particular points for 20 min. Specific points are ST-38, GB – 34, GB – 41, UB -11 and Local points are LI – 15, TW – 14,SI – 9, GB – 21.

Results: Both groupsshowed improvements within the group in total SPADI score and ROM. But Specific acupuncture shows significant changes in pain index *(P<0.002)*, disability index *(P<0.009)*, total SPADI score *(P<0.003)*, shoulder flexion *(P<0.004)*, abduction *(P<0.002)* and external rotation *(P<0.04)*.

Conclusion: Specific and local acupuncture point's may have similar effect on management of shoulder pain and range of motion, but the specific acupuncture points may have high therapeutic advantage on patient care and for further research studies.

Key words: Periarthritis of shoulder, acupuncture, shoulder pain, SPADI, range of motion.

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1.0 INTRODUCTION

Periarthritis of shoulder (PAS) is a common painful ailment of shoulder.**(1)**Neviaser in 1945 who given the term ‘adhesive capsulitis’ for painful stiffening of the shoulder.**(2)** ‘Frozen shoulder’ was another word used by codman**(3)**to describe insidious onset of pain felt near the insertion of the deltoid muscle, difficulty in sleeping on the affected side, restriction in both active and passive elevation and external rotation, withoutany radiological changes. However, Duplay in 1872 who initially described the condition as ‘periarthrities scapulo-humerale.**(4)** PAS is a clinical diagnosis rule out from a history of the gradual onset of severe shoulder pain with the progressive limitation of both active and passive glenohumeral movements.**(5)(6)**The most affecting movement for PAS is ‘external rotation’.**(3)(5)** The condition is commonly reported burden of middle age between 40 to 60 and is rare outside these age group and in manual labors**(7)** and is slightly more common in women.

PAS is believed to have an incidence of 3% to 5% in the general population and up 20% in those with diabetes.**(8)** It is common in persons with insulin-dependent and non-insulin-dependent diabetes.**(9)**Patients with PAS have ahigher risk of having certain form of prediabetic conditionwith an abnormal fasting glucose or impaired glucosetolerance test.**(10)**

PAS classified into four distinct stages namely painful, freezing, frozen and thawing stages.**(11)(12)(13)**PAS associated with pain causean immobilization of a shoulder. Extended immobilization of a joint has been shown to cause several detrimental pathophysiologic findings including decreased collagen length,

fibrofatty infiltrationinto the capsular recess, ligament atrophy resulting inreduced stress absorption, collagen band bridging acrossrecesses, random collagen production, and reformed sarcomerenumber in muscle tissue.**(14)**

The diagnosis of PAS is often one of marginalization. Early in the disease process it may clinically appear similar to other shoulder conditions such as major trauma, rotator cuff tear, rotator cuff contusion, labral tear, bone contusion, subacromial bursitis, cervical or peripheral neuropathy. Likewise, a history of a previous surgical procedure can lead to shoulder stiffness. If a history of these pathologies is negative and radiographs do not determine osteoarthritis, then the diagnosis can be definite as a PAS.

Now a days, there are many intervention options are accessible for PAS, which are anti-inflammatories, intra-articular corticosteroid injections**(15)**, capsular distension injections**(16)**, bupivacaine suprascapular nerve blocks**(17)**,manipulation under anesthesia**(18)**, arthroscopic release and repair**(19)**. Most of patients may also choose complimentary therapies like physiotherapy**(20)**, exercise therapy, electrotherapy, acupuncture**(21)**, hydrotherapy**(22)** for the management of pain and to progress ROM of affected joint.

Acupuncture is a traditional chinese medicine, which has been used clinically for more than 3000 years in East Asia. It has been described as an effective treatment approach in various diseases.**(23)** The function of acupuncture is related to insertion of needles at specific points of the body, mentioned to as “acupoints”, which produces functional specificity.**(24)**According to the philosophy of traditional acupuncture, energy circulates in the form of vital force called *‘Qi’ or*

'Chi' through the meridian or channels located throughout the body. The yin and yang are the two aspects of the *'Qi'* energy. They function as positive and negative polesand they are corresponding to each other.

By tradition there are twelve paired meridians and divides equally six *yin* and six *yang* meridians, which related to twelve internal organs of the body and are named conferring to the viscera of origin.**(25)**The disproportion between the *yin* and *yang*, results in various diseases and ill health. The way to reestablish energy circulation, health, and balance, is to stimulate the appropriate amalgamation of the estimated 400 traditional meridian acupuncture points in the body.**(26)**

Acupuncture points are alienated in several ways according to the function and location of the points. Important classifications are 12 meridian points, extra meridian points, floating or *Ah-shi* points, distal points. Meridian points are falling on the lines of the classical meridians. Extra meridian points are recently discovered and they exist mainly on the ear, hand, nose and head and some on the trunk. Floating points have no specific location. They exist in the locality of the affected part. Distal points have specific therapeutic properties on the proximal part of the body.**(27)**

In recent decades, acupuncture as a complementary and alternative therapy has been increasingly recognized in western countries. Current evidence suggests that acupuncture is aneffective intervention for treating pain**(28)** and musculoskeletal disorders.**(29)** There are numerous studies discloses that acupuncture triggers the endogenous opium and cannabinoidssystem to release several pain-ameliorating substances to ease pain.**(30)**Further research suggests

that the deleterious stimulation of the acupuncture needles may act to suppress the nervous system pathways that are involved in the sensory and affective components of pain.**(31)** Some studies indicates that acupuncture overwhelms inflammatory markers andmay possibly help toprogress physical function.**(32)**

Hence, PAS patients resorted to acupuncture therapy in various countries. Nevertheless studies reported that acupuncture is effective for PAS, the strength of evidence and its recommendation is still weak. According to a recent Cochrane systematic review, the effect of acupuncture for shoulder pain and its function improvement is still unconvincing. Current diminutive evidence is unable to affirm or refute the efficacy of acupuncture for PAS. It is of great importance to conduct a clinical trial with rigorous methodology to assess the effectiveness of acupuncture.

Importantly, acupuncture is a multifarious of needling therapies. Different acupuncture points may possess different treatment effects. Our clinical observation indicates that thecombined needling on specific and local *(ashi)* acupuncture points may have effective in treating PAS and recovers the function of shoulder joint. But, at present there is still no comparative study to evaluating the effective of specific and local points for PAS. Selected specific points for this trial areST(Stomach)-38, GB(Gall Bladder) – 34, GB – 41, UB(Urinary Bladder) -11 and local points**(33)** are LI(Large Intestine) – 15, TW(Triple Warmer) – 14,SI(Small Intestine) – 9**(34)**, GB – 21**(35)**. We therefore executed this one-centre, comparative trial to assess the independent effect onspecific and local acupuncturefor pain and its joint function in PAS.

2.0 AIMS AND OBJECTIVES

2.1 Aim:

To evaluate the efficacy of specific acupuncture points and local acupuncture points on pain, disability and range of motion in Periarthritis of shoulder (PAS).

2.2 Objectives:

2.2.1 Primary objective

To assess the shoulder pain and its restriction by SPADI (Shoulder pain and its disability index)

2.2.2 Secondary Objective

To assess the range of motion (ROM) of the shoulder by Goniometer

1) Flexion
2) Abduction
3) External Rotation.

3.0 LITERATURE REVIEW

3.1 Introduction to PAS

Periarthritis of shoulder (PAS) is a musculoskeletal disorder with self-limiting condition. Patients typically present with an atraumatic history of progressive painful restriction in range of movement of the gleno-humeral joint. They reveal a capsular pattern of limitation with external rotation and being the most affected followed by abduction in the level of the scapula and then finally flexion. In 1934 Codmandescribed a diagnostic criteria which involves of idiopathic onset, painful restriction of all gleno-humeral movements with limitation of flexion and external rotation without any radiological changes**(3)**PAS associated with pain can cause an immobilization of a shoulder. Prolonged immobilization of a joint has been shown to cause several detrimental pathophysiologic findings.

3.2 Epidemiology

Prevalence of PAS is approximately 2-3 percent in the general population.**(36)** It is peaks amongst 40-70 years of age and infrequent in children.**(37)** Women are more frequently affected than men, but there is no known genetic or racial preference. It is common in persons with insulin-dependent and non-insulin-dependent diabetes, and in those with pre-diabetes (glucose intolerance).

Persons with a history of PAS are at increased risk of developing the condition on the contralateral side. Recurrence on the affected side is also possible, especially in patients with diabetes.

3.3 PAS and Diabetes Mellitus

Studies have presented thatcorrespondence between PAS and diabetes mellitus (DM), with the incidence of two to four times higher when matched with general population. It affects about 20% of people with DM and has been described as the most disabling of the common musculoskeletal manifestations of diabetes. The prevalence of diabetes in patients with PAS was 38.6% and pre-diabetes was 32.95%. The total prevalence of a diabetic condition in patients with PAS was 71.5%. DM increases the risk of microvascular complications and believed to play a role in the development of musculoskeletal complications.**(10)**

3.4 History of PAS

Reeves, in a prospective study had a follow up for 5-10 years with 41 patients, out of them he have observed that 39% recovered completely, 54% had clinical limitation without functional changes, and 7% had functional limitation.**(38)**Shaffer *et al* showed that 50% of his 61 patients with PAS had certain degree of pain and stiffness on an average of seven years after onset of the disease.**(39)**

3.5 Phases of clinical presentation

Neviaser *et al***(40)** and Hannafin *et al***(41)** proposed 4 stages in PAS, which have been correlated with clinical examination and histological features.

Table-1 Clinical and histological stages of PAS

STAGES	SYMPTOMS	LENGTH OF SYMPTOMS	HISTOLOGICAL FEATURES
PAINFUL STAGE	Aching pain and moderate limitation of ROM	Less than 3 months	Synovitis and capsularhypertophy
FREEZING STAGE	Severe pain and reduction of ROM	3 to 9 months	Ipervascular synovitis.Disorganized Collagendeposition
FROZEN STAGE	Stiffness is predominant. Pain may persist.	9 to 14 months	Dense and hypercellularcollagenous tissue
THAWING STAGE	Minimal pain and agradual improvement of ROM	15 and 24 months	Not investigated.

3.5.1 Painful phase

First stage in PAS is the painful phase, which is characterized by a gradual onset of pain. It persists less than 3 months on the insertion of deltoid muscles and inability to sleep on the affected side. Patients may report a mild limitation of ROM which invariably resolves with the administration of local anesthetic.**(42)** Arthroscopic view shows a hypertrophic, vascularized synovitis without adhesions or capsular contracture.

3.5.2 Freezing phase

The second stage is called “freezing stage”. Symptoms continue for 3 to 9 months and are characterized by increases of nocturnal pain while lying down on the affected side, moreover a significant loss of both active and passive ROM can be noticed. Arthroscopic view shows a thickening of pervascular synovitis.**(42)** Histologically shows perivascular and subsynovial scar formation with deposition of disorganized collagen fibrils with a hypercellular appearance, but not any inflammatory infiltrates.

3.5.3 Frozen phase

In “frozen stage”**(42)**, symptoms persists 9 to 14 months. The shoulder stiffness is predominant and pain may persist at the end of motion or during the sleep on the affected side. Arthroscopic examinations demonstrate loss of axillary recess, patchy synovial thickening and biopsy shows dense hypercellular collagenous tissue.

3.5.4 Thawing Phase

The last stage is “thawing stage”. It is characterized by minimal pain and a gradual progression of ROM due to capsular remodeling. This stage take place between 15 and 24 months.**(42)** Arthroscopic and histological correspondence has not been investigated.

3.6 Physical Examination

ChronicPAS patients may lose natural swing of the arm that occurs while walking. Shoulder girdle muscle atrophy can be noticed. Impaired motion in the glenohumeral joint may result with abnormal scapular movement with active forward flexion of the affected shoulder. Physical examination of a patient with PAS can be discomfort and require brief rest or gentle loosen their arm to demonstrate the maneuvers.

Palpation may yield vague, diffuse tenderness over the anterior and posterior shoulder. Focal tenderness over a definite structure is rare and its presence suggests differential diagnosis or concomitant pathologies such as rotator cuff or biceps tendinopathy.

PAS susceptibility can be raised when flexion, abduction, and external rotation were restricted.Examination of the both shoulders can reveal the accurate assess deficits of the affected side. The patient should initially be asked to actively test the limits of motion; if loss of motion is observed, the physician may assist passively, with scapular stabilization to ensure an accurate measurement of movement.

3.7 Clinical Presentation

The hallmark of PAS is decreased range of motion and shoulder pain. There often idiopathic cause or trigger. The pain is often described as a poorly localized and deep ache. If the pain is localized, it is usually in the area of the anterior or posterior capsule. It may radiate to the biceps with progressive pain and stiffness when performing flexion, abduction and external rotation. Weakness is often correlated to pain or concomitant tendinopathy. Crepitus may be present on the involved side. Like other shoulder conditions pain may impair sleep. Unlike more serious causes of shoulder pain, otherwise it doesn't cause red flag symptoms such as high temperature, perfuse perspiration and weight loss. Neuropathic symptomslike numbness and altered sensation in the hand may have differential diagnosis such as cervical radiculopathy.

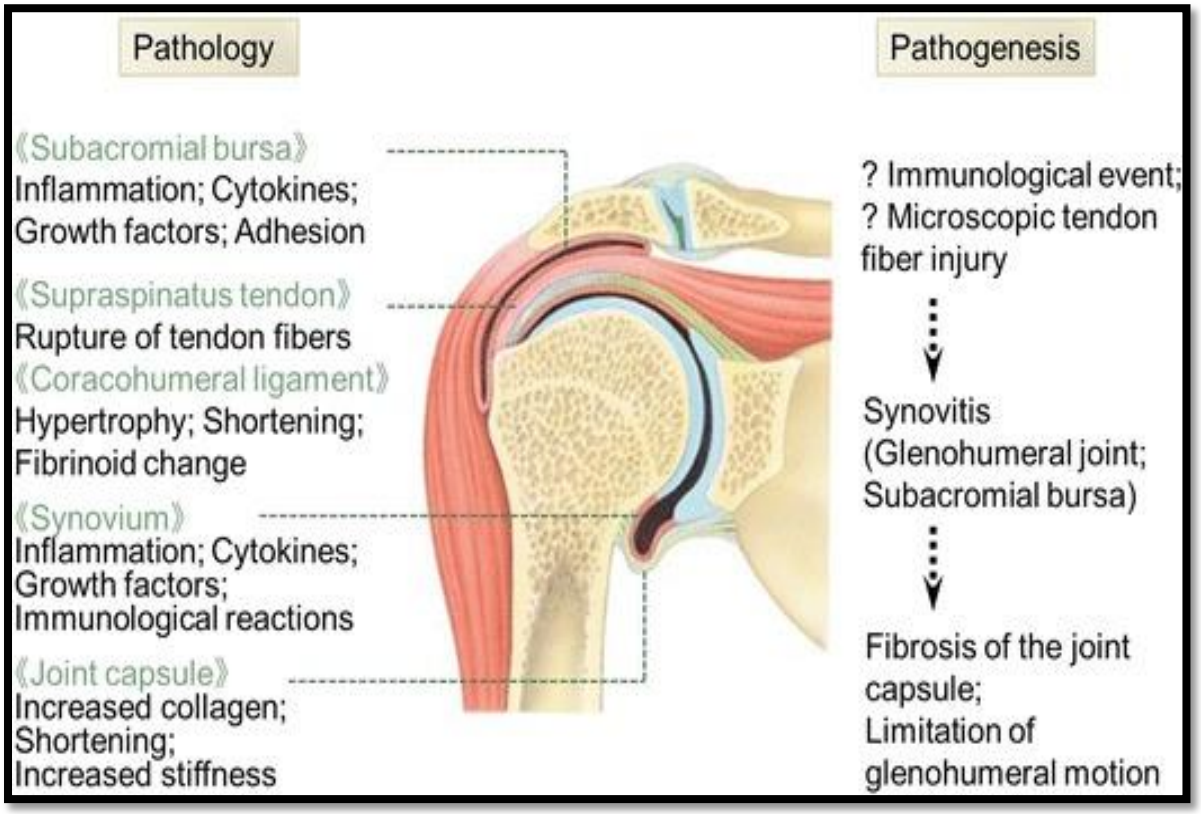
3.8 Pathogenesis

PAS includes both synovial inflammation and capsular fibrosis. Characteristically pain precedes with restriction, it is most likely to have inflammation with fibrosis.**(43)** Cytokines such as Tumor necrosis factor-alpha (TNF-alpha) and Interleukins (ILs) also cause synovitis in both the glenohumeral joint and subacromial bursa, however matrix-bound transforming growth factor beta (TGF-beta) may act as a persistent stimulus and resulting in capsular fibrosis.**(44)**Mechanism of initiator of synovitis is not known.Based on the response of immune system cells, it is postulated that immunomodulated chronic inflammation may play some role in the pathogenesis of PAS.**(43)** Another likely initiator of synovitis is degeneration or injury of the rotator cuff tendon. Tendon

injury may trigger induction of inflammatory mediators or fibrotic cytokines in the shoulder joint, whereas partial rotator cuff tear may cause joint contracture.**(45)**

In addition, there is no definite pathophysiology for the spontaneous occurrence of PAS in most cases. It is still uncertain whether PAS is a process similar to Dupuytren's contracture. There may be a failure of collagen remodeling from a genetic failure to activate gelatinase A, or from elevation of the levels of the natural inhibitor of matrix metalloproteinase (MMP) in the joint capsule.**(46)** PAS can be induced by administration of synthetic MMP inhibitor.**(47)**

Figure 1. Pathogenesis of PAS.



3.9 Differential Diagnosis

Diagnosis of PAS is generally clinical. Other conditions that would be considered in a patient who presents with a stiffness, painful shoulder include acromioclavicular arthropathy, autoimmune disease (e.g., systemic lupus erythematosus, rheumatoid arthritis), cervical disk degeneration,biceps tendinopathy, glenohumeral osteoarthritis, neoplasm, rotator cuff tendinopathy or tear (with or without impingement),subacromial and subdeltoid bursitis. PAS in the presence of related conditions is most appropriately defined as painful shoulder syndrome.

3.10 Diagnostic testing

3.10.1 Laboratory

Blood glucose parameters could be the priority of the physicians because of high prevalence of diabetes and pre-diabetes in patients with PAS. Additional serological tests are usually not indicated, but may be performed if they are suspecting any autoimmune or infectious conditions. C-reactive protein and erythrocyte sedimentation rate levels may be elevated in patients with PAS, but these tests are not sensitive or specific.**(48)**

3.10.2 Imaging

Definitive diagnosis of PAS can be obtained only through direct surgical observation. Nevertheless, this is not usually necessary. Other imaging techniques can be used to complement the past history and physical examination.**(49)**

The glenohumeral joint capsule is consisting of soft tissue; hence plain radiography may not be helpful. However, radiography can identify other shoulder

pathologies. X-rays can be useful to assess for pathologic fracture, pancoast tumors,avascular necrosis, calcific rotator cuff,advanced glenohumeral arthritis, and biceps tendinopathy.

Magnetic resonance imaging (MRI) is not diagnostic for PAS. Capsular thickening can be observed on MRI, it may also helpful in identifying other conditions such as subacromial bursitis and rotator cuff tendinopathy. **(50)**

3.11 Conventional Interventions

3.11.1 Steroid injection

Steroid injection is one of the high priority intervention for PAS. Numerous Cochrane reviews have concluded that eventual location of a subacromial orblind glenohumeral injection is highly variable.**(51)** Recent Cochrane review collates the result from twenty six heterogenous studies and concludes that there is a small short term benefit to steroid injection alone for PAS but the evidence is indefinite.

3.11.2 Anti-inflammatories

Uses of anti-inflammatories or corticosteroids are the important in the treatment of PAS. Non-steroidal anti-inflammatory drugs (NSAIDs) may be used during any stageto relieve symptoms.**(52)**

No evidence has proved to indicate that NSAIDs change the prognosis of PAS. However, NSAID's are involved not only in the action of anti-inflammation but also producing analgesic effect. So it can be reasonable prime choice for PAS.

Moreover, No comparative study has done on oral corticosteroids with placebo or natural history of the PAS. Most studies have showed that

corticosteroids may reduce pain than rehabilitation or placebo but their outcomes are not maintained long term.

3.11.3 Intra-articular corticosteroid injections

Although high-quality RCT of corticosteroid injection for treatment of PAS have not been done, availability of some evidence on intra-articular injections shows that having short-term benefit of their use. Minimal complications of using this invasive procedure like subacromial injection or glenohumeral injection may be considered. Limitation of administrating injections is blind with inaccuracy of 60%.Advance clinical practice may help to have greater accuracy.**(53)** This limitation can be overcome by use of imaging techniques such asultrasound guided joint injection.

3.11.4 Capsular distension injections

This mode of treatment should bedone under local anesthesia. Affected joint is injected with local anesthetic to stretch the capsule. Thistechnique is often poorly tolerated because of pain that isexperienced during the procedure of intra-articular injection. So capsular distention injections may be unfamiliar.**(54)**

3.11.5 Surgical treatment

The treatment of PAS should lead to the surgical treatment only after conservative management has not given any progress. There is no definite deadline to intervene surgery. As a general rule patients should not noticing any progress in the symptoms, after taking some form conservative management for at least 2 months. Patients those who are having significant pain and limitations can proceed with surgical intervention.

3.11.6 Manipulation under anesthesia

Manipulation under anesthesia method allows to restoring the ROM of the shoulder in the operating theatre. Immediate postoperative physical therapy can be required for this method. **(55)**Disadvantage of manipulation is pain after recovering from the anesthesia. It may be happening because of tissues stretched during the manipulation under anesthesia. This can be potentially slow recovery process. When it adding with surgical release it induces further surgical trauma to the shoulder and may cause slow rehabilitation.

3.11.7 Arthroscopic release and repair

Arthroscopy is an additional tool for addressing the shoulder with PAS. Essential lesions are tightened coracohumeral ligament and rotator cuff interval with the contracted capsule including the axillary pouch on the affected joint. These structures can be preserved by release with arthroscopic instruments. ROM of the shoulder can be maintained under arthroscopic release with manipulation, if necessary. The release can be executed either before, during, or after the manipulation.**(56)** The manipulation may need to precede the technique to gain access to the joint. Arthroscopy allows complete evaluation of the shoulder and its anatomy as well. Any pathology that may not have been diagnosed can be addressed with this procedure. This procedure may make postoperative ROM less painful and decreases the recovery period. Operative treatment of PAS has been shown to reduce the duration of the disease and to return ROM with good prognosis. Total recovery of pain-free ROM averages 2.8 months and time taken for formal physical therapy is 2.3 months.**(57)**

3.11.8 Rehabilitation

Multiple studies were observed the efficacy of rehabilitation on PAS. In general, most of the studies establish various degrees of improvement in pain scores, ROM, and function following various treatment approaches.**(58)**

3.11.9 Patient education

PAS is so painful and has a very slow progression of resolution. Patients should be educated the slow prognosis of the condition and inclusion of complication of the PAS, if any. If they know and understand ahead of time that it can be several years before symptoms are entirely resolved, apprehension and urgency for functional return may be diminished.

3.12 ACUPUNCTURE

Acupuncture is a traditional chinese medicine with its origin over 2,500 years in china and used for treating various ailments.**(59)** Acupuncture methods are carried out by inserting very fine needles into the specific points of the body. Its name originating from the Latin words *acus* means "needle" and *pungue* means "pricking".**(60)** By stimulating these points either manual needling, electrical stimulation (electroacupuncture), heat (moxibustion), pressure (acupressure) or laser energy in order to realign the body's "vital energies".

3.12.1 History of Acupuncture

In prehistoric period they had no knowledge of metals, so they were used sharp stones, woods, and blunt objects as a needle. Sho Wen Jie Zi of the second century used the word *'bian'* as a sharp stone to prick at the body surface to treat the illnesses. These *bian* stones were replaced by needles made of bone or bamboo. During Shang Dynasty around 16-11 century B.C. uses of bronze needles came into practice. In the course of evolution needles were replaced by iron, silver and gold. In an excavation of an ancient tomb in 1968 in maohing founded golden and silver antique needles. Bestowing to the ancient text, acupuncture and herbal therapy was initiated by two ancient deities known as Huang Di and Shen Nung. (3737-2697 B.C.)**(61)**

Later in 2697 B.C. Nei jing formulated the typical chinese medicine, principles of anatomy, health and well-being in a book called the Huang Di ing Su Wen, Yellow emperor's classic of internal medicine. The first part of the book comprises the ideologies of medicine and the philosophy of the universe as it

relates to the human health. Second part of the book explains about the acupuncture, deals with the prevention and cure of illness or aliments.**(62)**

The ancient chinese philosophic theory of the five elements and the concept of yin and yang have evolved during spring and autumn period. (770-467 B.C.) The theory of meridians, Luo connecting and flow of *'Qi'* are the nucleus of acupuncture philosophy.**(63)**

Acupuncture points were first systemically described during Tsin Dynasty (A.D. 250-420) and explained about 657 acupuncture points including 354 basic acupuncture points. In the Tang Dynasty (A.D. 618 – 907) a special acupuncture department was established at the Imperial medical college of china. During A.D. 960 – 1297 acupuncture was further organized and officially recognized by forming official manual.

In Han Dynasty spreading of Taoism in china leads to methodization of acupuncture and herbal medicine. During this period they have introduced theories of yin and yang and were promoted as the basis of life. Huang Fu-Mi (215 – 282 A.D.) wrote a book called *"chia ching on moxibustion and acupuncture"*. Wang Shu wrote book called *"Ne-Jing"* he explained about pulse diagnosis, at the end of Han era.**(64)**

During Ming Dynasty (1368 – 1644) china had started using combined knowledge of western medicine and acupuncture. During the both ching Dynasty (1644 – 1911) and the nationalist china (1911 – 1949) acupuncture lost favor of the rulers. After the origin of People's Republic of china in 1949, development of traditional acupuncture ascends again. Most recent methods are needling of hands,

nose, ears, face and scalp, needling with long fine needles, hot needles and injection of distilled water in certain points, an instrument for detecting the points and a glass figure marked with acupuncture points. These developments were done in 1958.

Scientific medical science, researchers were showed some light on acupuncture and its mechanism through neurophysiology, relation with the hypnosis, and darwin theory of evolution. The outstanding contributions of Ronald Melzack and Anton Jayasuriya are motor gate control theory of late motor recovery for relieving the pain. Advance development of kirilian photography showed a new dimension on acupuncture.

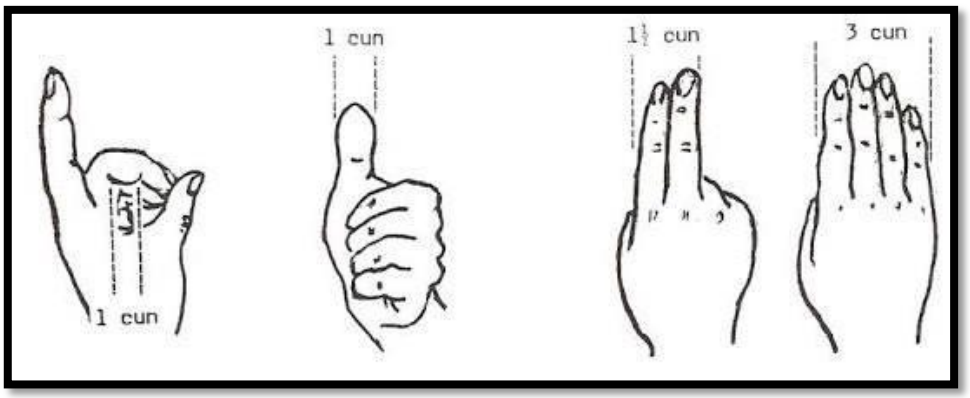
3.12.2 Surface Anatomy

Acupuncture treatment depends on both selection of points and precise location of the point. Anatomical landmarks on the human body are essential for locating the points.

Unit of the measurement used in acupuncture is *t-sun* or *cun*. One t-sun is defined as the distance between the palmar creases over the proximal and distal interphalangeal joints of the middle finger of the patient. Breadth of the thumb is also considered as one t-sun.

The combined breadth of the index and middle or ring and little finger is 1.5 t-sun. The combined breadth of the four fingers is 3 *t-suns*.

Figure 2: Measurements of Acupuncture



3.12.3 Theories of acupuncture

Ancient philosophical theories are essential to understand the fundamentals of acupuncture. The theory of acupuncture is depends upon meridians and acupuncture points. Meridians are designated routes through *'Qi'* or *'Chi'*.

3.12.3.a Concept of Qi

'Qi' is a vital motivating energy in the body. This vital energy neither been established nor assessed, it can be only experienced and appreciated. In Indian philosophy it is known as *Prana.* Yogis describedit as a *prana vayu*. The principle of *prana* and *prana vayu* is quite related to the traditional chinese concept of *'Qi'* or energy of life. *'Qi'* is universal and it present all over in different forms. In body *qi* permeates all living cells and tissues. It is invisible force responsible for circulation, respiration, digestion, reproduction and elimination.**(65)**

3.12.3.b Principles of Yin and Yang

Yin and Yang are the two aspects of the *Qi* energy. Yellow emperors have explained the principle of yin and yang are the origin for entire universe. This theory was elaborated in the book called 'classic of internal medicine'. State of good health can be maintained by balancing the yin and yang and their

disturbances may results in a disease. They function as two opposite poles, negative and positive and complementary to each other. Yang stands for male and yin represents female.

3.12.3.c Network of '*Jing Luo*'

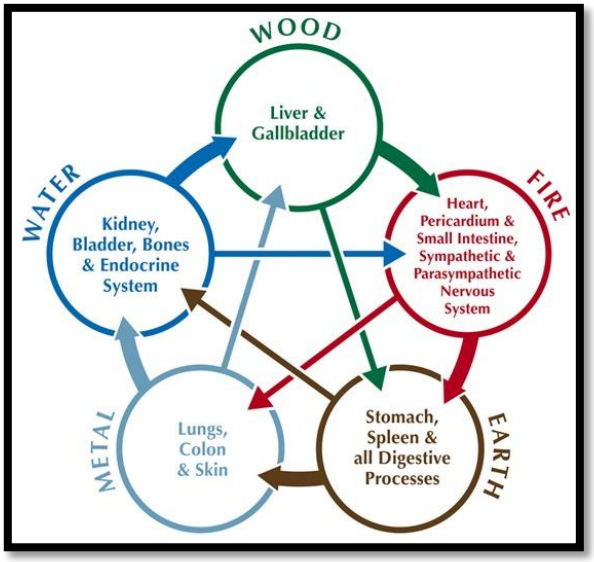
The pathway through which *'Qi'* flows in the body is called meridians or channels. It termed as *Jing Luo,* which means path *(Jing)* and Connection *(Luo).* Meridians transforms all over the body especially it movesvertically from below upwards or above downwards is main meridians, traditionally they have termed as *Jing.* There are twelve paired main meridians and eight extra ordinary meridians. Main meridians have collateral to each other at some points; they will describe these pointsas a *Luo.***(66)**

Twelve pair of meridians divided into two classifications namely solid or *Zang* organs and hollow or *Fu* organs. *Zang* organs are negative *(Yin)* and *Fu* organs are positive *(Yang)* in polarity. This*yin* and *yang* meridians are linked *(Luo-Connecting)* by collaterals. *Yin* meridians are lung, pericardium, heart, spleen, liver, and kidney. *Yang* meridians are large intestine, triple warmer, small intestine, stomach, gall bladder, urinary bladder.

3.12.3.dConcept of five elements

According to the traditional chinese concept the entirecosmos is divided into five elements. In the living body they symbolize the internal organs and their cycles explain the phenomenon of nature. Theory of five elements with constructive and destructive principles is explained in the figure 3.

Figure 3: Concept of five elements



3.12.3.e Traditional law of energy flow

'Qi' flows through definite rules or laws in respect of the direction, time and side of the body. The knowledge of the energy flow is essential for choosing the meridian and acupuncture points for specific disease.

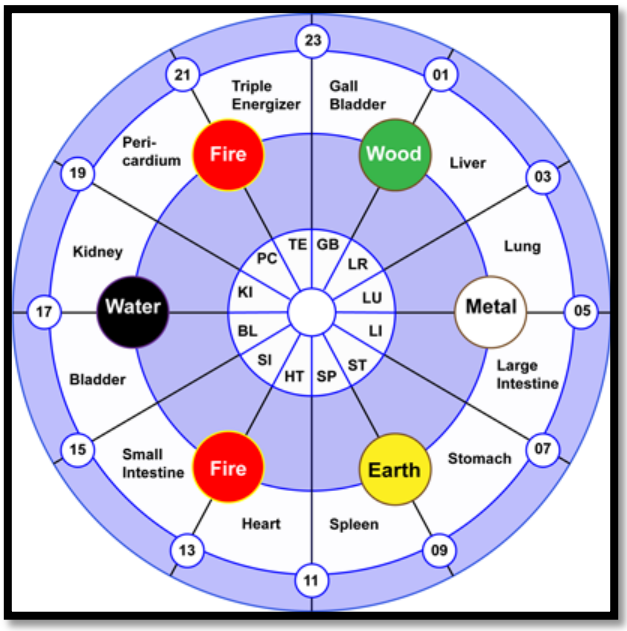
Mother and son law: *'Qi'* always flows from mother to son. For the proper flow of energy mother should be well nourished herself to provide and the child should be strong enough to receive the energy. In the flow of energy the son becomes the mother of the subsequent meridian after receiving the energy and in turn the recipient organ becomes the mother of the next following organ. Thus liver is the mother of heart, then heart is the mother of spleen and so on.

Husband and wife law: Husband governs the wife, *yang* dominates *yin* and left wrist pulse dominates right wrist pulse. Organs related to the husband are small intestine, heart, gall bladder, liver, urinary bladder and kidney. Wife related organs arelarge intestine, lung, stomach, spleen, triple warmer and pericardium. In

the normal balanced rhythm, left wrist pulse should be slightly stronger than the right wrist pulse.

The mid-day mid-night law and organ clock: It describes the relationship between the organs receiving maximum flow of energy. The organ clock shows the circulation of vital energy through various organs and meridian in relation to time. Having knowledge of this law is helpful in selecting the time to treat disease in order to achieve maximum benefit.

Figure 4: Organ Clock



3.12.9 Modern Theories

3.12.9.1 Neurophysiological mechanism

Nervous system and nerve impulses, conductions are the important factor to understanding of acupuncture in a scientific view. Previous trials observed that pre-anaesthetised acupuncture points were not showed any effect. This indicates that acupuncture mechanism may involve through the nerves system. Autonomic nervous system (ANS) also plays an vital role in the mechanism of

acupuncture.**(67)** Ling and Clive *et al* have proved the involvement of ANS by applying electrical stimulation at acupuncture point Liver 8 to cat.**(68)** They have observed that potential variations in the hypothalamus control the centres of ANS in brain. Another experiment has done on rat by lee, he have applied electrical stimulation to ST 36 in rat. He noticed significant reduction in blood velocity after 10 min of stimulation of sympathetic nerve controlling vasoconstriction.**(69)**

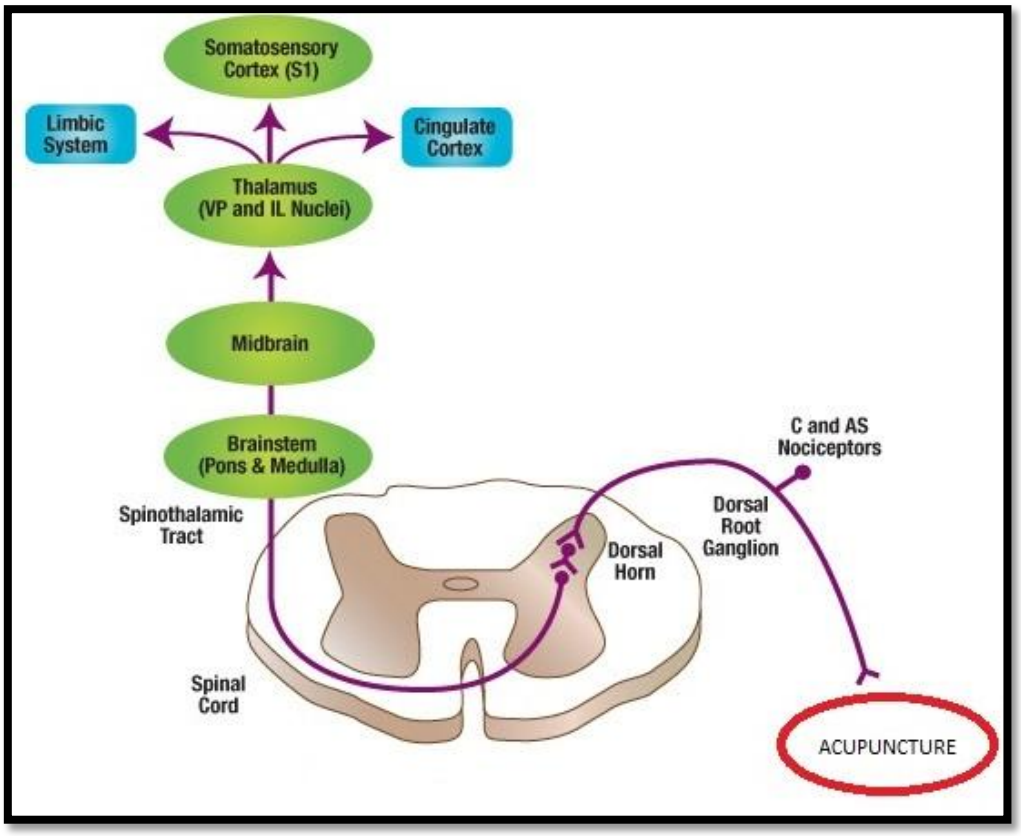
Sensation and functions of internal organs are regulated through the sensory nerve impulses, coding pattern and frequency of ANS. If the pattern or frequency changes before reaching the destination, it may reflect changes in the sensation. This physical mechanism involved in the nerve impulse can be changed by external stimulation. Acupuncture is one of the main external stimulation for altering neural coding by electrical and thermal intervention.**(68)**

3.12.9.2 Gate control theory

This theory explains about the physiology of pain. Pain impulses are first controlled and modulated in the substantia gelationosa of the spinal cord known as first functional gate, then impulses passes up through opposite spino-thalamic tracts called second functional gate.**(70)** When it reaches cerebral cortex, patients may feel pain. Wald has suggested existence of some other functional gates, namely paraventricular, contralateral nuclei of the thalamus and the medial reticular formation of the mid-brain. Stimulation of acupuncture points creates over-crowding of the impulses at the functional gates and blocks the nerve impulses then give raises pain threshold and analgesia.

Gate theory emphasizes stimulation of large, highly myelinated (afferent A-beta fibers) block the transmission of pain signals by relatively small, nociceptive fibers with no myelination (A-delta and C fibers) at the level of the spinal cord. Small, unmyelinated C fibers are responsible for chronic and throbbing pain. However, larger A-delta fibers with minimal myelination are responsible for fast transmission, acute and intense pain. It is hypothesized that electrical stimulation decreases the perception of pain by increasing the activation of A-beta fibers. Therefore, Over-crowding of pain signal pathway may close the gate of transmission in the spinal cord.**(71)** These target cells are located in the substantia gelatinosa of the dorsal horn.

Figure 5: Mechanism of gate control theory



3.12.9.3 Motor gate theory

The phenomenon of motor gate theory was explained by jayasuriya and Fernando in 1977. According to theory of motor gate, functional motor gates are blocked in the pathological conditions. Mechanism of motor gate theory comprises of efferent pathway which arises from axons of anterior horn cells to the motor end plates. Secondly, Renshaw cells situated in the ventro-lateral part of the ventral horn of grey matter and cajal cells are in the intermediate nucleus of cajal are in synaptic connection with anterior horn cells. Efferents give synaptic influences to renshaw cells, which are excitatory in type. Renshaw cells in turn to have axons which effect synaptic connections back to anterior horn cells.**(72)**

Hyperactivity of the cells leads to an increase in the inhibitory effect exerted on anterior horn cellsthrough renshaw and cajal cells including return to neutral activity.Normally gates situated between anterior horn, renshaw cells and cajal cells are open.**(73)** When an acupuncture needle inserted in a certain point afferent pathway is potentially capable of acting on the anterior horn cells through the intermediate cells of cajal.

3.12.10 Recent evidences

3.12.10.1 Release of endogenous opioid

Studies have been observed needling of acupuncture points may activates the mechanoreceptors and sends afferent signals to ventrolateral tracts, which activates brain nuclei that modulate pain sensation through the descending inhibitory pathways.**(74)**

Clinical trials and experimental studies founded that endogenous opiate peptides involved in acupuncture for its analgesia effect. Based on animal experiments, it was observed that needling of acupuncture points lead to the endogenous release of different classes of analgesic neuropeptides namely enkephalin, betaendorphin, endomorphin and dynorphin.**(75)(76)**

Zhang *et al* experimented acupuncture to rats with complete Freund's adjuvant (CFA)induced inflammatory pain and found a significant alleviation of hyperalgesia that was blocked by spinal administration of m-, d-, but not k-opioid receptor antagonists.**(77)** They also establisha role of opioid release in acupuncture with co-administration of low-dose morphine which synergistically enhanced such m- and d-receptor.

Recent studies demonstrated by blocking the effect of acupuncture with peripheral intraplantar administration of opioid antagonist. They have concluded acupuncture releases both central and peripheral opioids to attain analgesia.**(78)**

3.12.10.2 Adrenergic system modulation

Noradrenaline has neurons that originate from various parts of the brain including raphe nuclei, locus coeruleus, periaqueductal gray, and A1, A2, and A4-

7 nuclei of the brainstem, which project to the forebrain and descend along the dorsolateral tracts of the spinal cord, plays a vital role in pain modulation.**(79)**

Experimental studies with rats have shown correlation of acupuncture-induced analgesia in association with a decreased level of noradrenaline in the brain.**(80)** However,functions of noradrenaline seem to be diverse in the spinal cord depending on the receptors. Kim *et al***(81)**found that a2 adrenergic receptor blockers abolished acupuncture analgesia on cold allodynia of rats with neuropathic pain but not on a1 receptor blockers. This finding was in line with our understanding, a2-adrenergic receptors suppress nociceptive signaling whereas a1-adrenergic receptors facilitate in the spinal dorsal horn.**(79)**

3.12.10.3 Modulation of 5-hydroxytryptamine system

Chang *et al***(82)**done an experiment in rats, they have found that acupuncture analgesia may involve the 5-hydroxytryptamine (5-HT) neurotransmitter in the inflammatory pain. Analgesiceffects was abolished by intraventricular administrationof antagonist's 5-HT1A and 5-HT3 receptors but potentiated by 5-HT2 receptor antagonists. Similar findingswere confirmed by Kim *et al***(81)**for neuropathic pain ina rat model with spinal nerve transection and intrathecalinjection of 5-HT receptor antagonists.

3.12.10.4 N-methyl-D-aspartic acid/AMPA/Kainate signalling

Signaling system of glutamate and its receptors N-methyl-D-aspartic acid (NMDA), a-amino-3-hydroxy-5-methyl-4-isoxazolepropionic acid (AMPA) and kainite is essential in the processing of spinal nociception and central sensitization**(83)**. Blockade of NMDA receptors enhanced the analgesic effects of

acupuncture in a neuropathic pain**(84)** and Zhang *et al***(85)**reported the identical phenomenon in rats with hyperalgesia triggered by CFA-induced inflammatory pain. Immunochemical techniques by Sun *et al***(86)**says, electro acupuncture at 2Hz reduces the neuropathic pain in the dorsal spinal horn of rats through the modulation of pain behavior and the expression of NMDA receptor subtype NR1.

3.12.10.5 Modulation of other neurotransmitter systems

Involvement of nociceptive mediators has been noticed in the acupuncture, including somatostatin, glial-derived neurotrophic factor, and cannabinoids. Dong *et al* observedthat expression of somatostatin mRNA**(87)**and glial-derived neurotrophic factor mRNAin the dorsal root ganglion and in the spinal dorsal hornduring electro acupuncture (EA) in rats. Chen *et al***(88)**used EA in both 2 Hz and 100 Hz on rats. They have found that significant reduction in the pain. They have hypothesized the mechanism by blocking of selective CB2, but not CB1 receptor antagonists and suggesting that EA induces analgesia through an increase in endogenous anandamide and an activation of CB2 receptors.

3.12.10.6 Anti-inflammatory theory

Langevin *et al* observed that manual manipulation of acupuncture needle in rats may led to a dose dependent cytoskeletal remodeling with dispersion of fibroblasts.**(89)** Such mechanical action can resulted in the micro trauma around the needle which leads to formation ofmast cell degranulationand the release of various pro-inflammatory mediators like tumor necrosis factor alpha (TNF-a), interleukins, chemokines and macrophages.**(90)** This inflammation process continues to produce neuronal hyper excitability withintensification of nociception

may results in chronic and neuropathic pain.**(91)** The modulation of acupuncture on interleukins and TNF-a have been documented in osteoarthritic**(92)**, inflammatory**(93)**, and neuropathic pain. Xu *et al***(94)**also noticed the reduction in serum interleukin-1b and TNF-a in the osteoarthritic pain. Correspondingly, Yuan *et al***(95)**had a study with patients those who having chronic pelvic pain syndrome andthey havenoticed that marked improvement in reduction of prostatic fluid levels of TNF-a, interleukin-8, and interleukin-10.

3.12.10.7 Modulation of long-term depression and long term potentiation neural plasticity

In 1970's**(96)**, the phenomena of long-term potentiation (LTP) and long-term depression (LTD) was originally described in the CA1 area of the hippocampus of the brain as the basis of neural plasticity for learning and memory.**(97)** However, recent research has demonstrated the role of LTP/LTD neural plasticity may postulate mechanisms for EA analgesia. Xing *et al***(98)**used extracellular investigations to obtain insight knowledge of acupuncture. Interestingly they have observed 2 Hz of EA induced the LTD of C fiber evoked field potentials in the spinal dorsal horn of rats with neuropathic pain, and such LTD was obliteratedby the NMDA receptor antagonist. Same rats was used at 100 Hz instead of 2 Hz for EA, it induced LTP with neuropathic pain, this effects being mitigated by g-aminobutyric acid and 5-HT receptor antagonists.**(99)**

Similarly, Ma *et al***(100)** applied 2 Hz EA to rats with neuropathic pain caused by CCI and found that EA significantly inhibited the C-fiber-evoked potentials of LTP. Such mechanism of LTP/LTD neural plasticity may correlate

with the long-term analgesic effects of acupuncture that can be experience in clinical practice.

3.12.10.8 Activation of the diffuse noxious inhibitory control system:

Nociceptive inputs from sensory afferents are modulated by descending inhibition from supraspinal and higher centers. This phenomenon is known as diffuse noxious inhibitory control (DNIC). Anatomically, DNIC consists of ascending pathways from spinal cord ventrolateral quadrant to the supraspinal centres and descending projections from supraspinal centres of dorsolateral funiculi to the spinal dorsal horn.**(101)** DNIC is plays a vital role,when two different noxious stimuli are applied at the same time, which means a second stimulus outside the receptive field of the first inhibited neuron.**(102)**

Reduction of DNIC may lead to decreases of endogenous pain inhibition. Hence, contribute to a chronic pain. Animal experiment studies have shown that EA triggers DNIC and alleviatesnociception from somaticor visceralareas. Such effects may diminished by capsaicin management, which destroys C-fibers.**(103)** Clinical studies have suggested EA given at local points may mediate analgesic effect by stimulating large diameter Ab fibers, whereas EA analgesia at distal points was mediated through smaller diameter of Ad- and C-fibers by engaging the DNIC system.**(104)**

3.12.11 Acupuncture and PAS

Previous systematic review by green *et al***(105)** concluded that acupuncture can be used has a complimentary treatment for shoulder pain and to restore its function. They have also mentioned only few studies were supporting acupuncture in the management of PAS. Moreover, no adverse reaction was noticed on the any of the studies. Some studies were not included in the review because of lack in methodology. Another comparative study was conducted to rule outthe therapeutic benefits of normal acupuncture and shallow needling with short needles on PAS. One hundred and fifty-two cases were recruited and randomly divided into two groups. Result of the study shows that pain was reduced 67.1% and 69.7% in normal and shallow acupuncture respectively, with no significant changes between the groups.**(106)**

Chen SJ *et al* in 2006 conducted a randomized controlled study on therapeutic effects of three phases and routine acupuncture method on PAS. Seventy patients were selected and divided in the two groups with thirty five in each. Result shows that effective rate was 97.15% in the three phase acupuncture group and 87.10% in routine acupuncture group. They have concluded three phase method may be have high therapeutic effect than the routine acupuncture method.**(107)**

Another study was conducted to assess effectiveness transient therapeutic effect and safety of *fu*-needle and a routine acupuncture group. Sixty cases of PAS were randomly divided into two groups. The articular mobility of the most limited direction, soft tissue pain and self-rating score of shoulder tenderness were

assessed before and after treatment. Stabbing time, degree of the needle, scattering, was monitored during retention of the needle. Bleeding at withdrawing the needle was also compared between the groups. Improvement of mobility-related pain, tenderness, and the articular mobility of the most limited direction, indicating that the transient effect in the *fu*-needle group was better than the routine acupuncture group, and the stabbing times and degree at insertion of the needle were less than the routine acupuncture group. There was no significant difference between the two groups in stabbing times, degree at scattering, retaining the needle and bleeding times in withdrawing the needle.**(108)**

A single-blind randomized, controlled trial was conducted to evaluate the efficacy of individualized acupuncture based on traditional Chinese medicine, standard acupuncture points used for shoulder pain and sham non penetrating acupuncture. Thirty-one subjects were randomized to one of three treatment groups. Subjects received 12 sessions over 6 weeks and were assessed using the Shoulder pain and disability index (SPADI). The mean total SPADI score improved in all three groups, but the change was clinically significant only in individualized acupuncture group and standard acupuncture group. They have concluded acupuncture may be an effective treatment for chronic shoulder pain. They suggested that the use of standard points may make treatment convenient for patient care.**(109)**

Multi-centric research study was conducted on comparison of traditional acupuncture, sham acupuncture and conservative orthopedic treatment on chronic shoulder pain for 15 treatments in 6 weeks. They were assessed visual analog scale

(VAS) immediately after the treatment and after 3 months. Their result shows that both traditional and sham acupuncture was statistically significant than the conservation orthopedic treatment.**(110)**

Another study was conducted to optimize intervention for PAS with acupuncture, moxibustion and positive functional exercise with orthogonal design.**(111)** The short-form McGill pain questionnaire (MPQ) and shoulder joint motor disturbance score were evaluated.They have advised combined therapy of local acupuncture, warm needling and positive functional exercise for acute stage of PAS. At the chronic stage the combined therapy of local and distal acupoints, with filiform needle and warm needling and positive functional exercise could be beneficial.

In 2012, Yang R *et al***(112)** conducted a study on clinical observation of PAS with BO's abdominal acupuncture according to the stages which it was affected. They were recruitingninety-six patients and randomly divided into an acupuncture group and an abdominal acupuncture group, 48 cases in each. According to clinical pathological condition they were made two stages called pain and adhesion stage. In abdominal acupuncture group, 24 cases were in pain stage and treated with acupuncture at *Zhongwan* (CV 12), *Shangqu* (KI 17) on the healthy side, *Huaroumen* (ST 24) on the affected side and others; 24 cases were in adhesion stage and treated with acupuncture at *Zhongwan* (CV 12), *Xiawan* (CV 10), *Qihai* (CV 6), *Guanyuan* (CV 4). In acupuncture group, there were 24 cases in either pain stage or adhesion stage, treated with acupuncture at *Jianyu* (LI 15), *Jianliao* (TW 14), *Jianzhen* (SI 9). In either group, the treatment was given three times a

week for three weeks. They have used the VAS and functional activity score (Mallet score) for the assessment of shoulder joint. They concluded that abdominal acupuncture show significant changes in both pain and adhesion stages.

Recently another study was conducted on abdominal acupuncture for adhesion stage of PAS.**(113)** Totally 137 cases were randomly divided into abdominal group (79 cases) and a body acupuncture group (78 cases). They have selected*Zhongwan* (CV 12), *Shangqu* (Kidney 17) and *Huaroumen* (ST 24) in the abdominal acupuncture group and *Jianyu* (LI 15), *Jianliao* (TW 14) and *Jianzhen* (SI 9) in the body acupuncture group. The treatment was given three times a week for both groups and ten times made an observation course. Before and after treatment, visual analogue scale (VAS) was adopted for pain assessment and functional activity score (Mallet score). Result of the study shows the total effective rate in the abdominal acupuncture group was higher when compared to the body acupuncture group. The score of VAS and the functional activity score was not statistical significance between each other. They have concluded that abdominal acupuncture may be ideal treatment for PAS on adhesion stage, which has better total efficacy than routine acupuncture. Moreover, have an advantage at fast selection of acupoints and less discomfort of needling sensation.

Qing-Nan Fu*et al*, in 2014, formulated a multicenter, single blind, factorial randomized controlled trialto evaluate the efficacy of local acupuncture points in combination with distal acupuncture points on pain relief and shoulder function improvement in chronic shoulder pain.Their primary outcome wasshoulder pain intensity graded with VAS and secondary outcome was the Constant-Murley score

(CMS) for the function of shoulder.Data extraction was at baseline, 6 weeks after the first acupuncture, 10 weeks after the first acupuncture and 18 weeks after the first acupuncture.**(114)**

Another RCT was done to evaluate the effectiveness of sharp-hook acupuncture *(Feng Gou Zhen)* on PAS. They were recuirted 132 patients and assigned into acupuncture and control group. Patients from both groups were evaluated at week 0 (baseline), week 1, and week 4. The primary outcome was shoulder pain, measured by visual analogue scale at 7 days after treatment. Secondary outcome was function of shoulder joint and McGill pain questionnaire. The results showed that patients in acupuncture group had better pain relief and function recovery compared with control group at 1 week after treatment. Moreover, there were statistical differences between two groups in VAS, shoulder joint function and McGill pain questionnaire at 4 weeks after treatment. Therefore, the sharp-hook acupuncture helps to relieve the pain and restore the shoulder function for patients with PAS.**(114)**

Another research was conducted on immediate pain relief on PAS by acupuncture, observer-blinded placebo-controlled study. Sixty volunteers with primary PAS were randomly assigned to acupuncture with press tack needles compared with press tack placebos. Thirty-four volunteers received conservative therapy including 10 classical needle acupuncture treatments over 10 weeks and 13 volunteers received conservative therapy without classical needle acupuncture.Result shows that an immediate improvement of pain was seen in the press tack needles group and in the press tack placebos group. Conservative

therapy including classical acupuncture needle shows significantly improved in pain management when compared with only conservative therapy. They have concluded that integrating acupuncture conservative therapy showed more effectiveness compared with conservative therapy alone.**(115)**

4.0 MATERIALS AND METHODS

4.1 Subjects

A total sixty subjects of both gender with age ranging between 40 – 65years were participated in the study.

4.1.1 Description of the subjects and selection of samples

The study subjects were randomly recruited from the government yoga and naturopathy medical college and hospital, Arumbakkam, Chennai. The Subjects were recruited for the study from the above mentioned hospital after fulfilling inclusion criteriaby screening of the subjects and by providing informed consent. Sixty participants were screened through a routine medical check-up and those are satisfying the diagnostic criteria for PAS were recruited for the study.

4.1.2Demographics

Table 2:Describes the demographic details of the subjects

Contents	Specific acupuncturegroup	Local acupuncture group
Age (Mean ±SD)	53.46 ± 7.88	54.36 ± 7.62
Subjects	30	30
Sex (Male/Female)	13/17	15/15

SD – Standard deviation

4.2 Ethical Considerations

4.2.1 Ethical Clearance

Ethical clearance was sought from the Institutional Ethics Committee prior to the start of the study and the approval for the same was granted.

4.2.2 Written Informed Consent

Subjects who fulfilled inclusion criteria were apprised about the purpose of the study and their rights as research subjects. Informed consent form was administered in English and regional language Tamil.Sufficient time was given to each patient to go through the information sheet and their queries were answered. Their right to withdraw anytime from the study and the need for willingness to participate voluntarily in the study was explained. All the subjects expressed their willingness to participate in the study by giving a signed informed consent.

(A sample consent form and case sheet is enclosed as **Annexure I and II** respectively)

4.3 Screening of the subjects

4.3.1 Criteria for Diagnosis (116)

The necessary criteria for the diagnosis of a PAS are:

(i) **History**

- Functionally significant restriction of shoulder motion
- Absence of history of previous major shoulder injury or surgery

(ii) **Physical examination**

- Limited glenohumeral motion in all directions

(iii) **Radiographs**

- No changes in cartilaginous joint space
- Absence of pathological changes other than osteopenia

4.3.2 Inclusion Criteria

1. Shoulder pain for at least 1 month and less than 12-month duration
2. Appreciable restriction of both active and passive motions with abduction and flexion not exceeding 90° and external rotation not exceeding 30°
3. Pain at night, with inability to lie on the affected side.
4. Age between 40 years and 65 years.
5. Both genders
6. Receiving no treatment in the last 4 weeks.
7. Providing written inform consent.Agree to co-operate for the study and to follow instructions of doctors.

4.3.3 Exclusion Criteria

Participants will be excluded if they have:

1. History of major shoulder injury or surgery.
2. Clinical or radiological evidence of other pathologies that could possibly account for the symptoms.
3. Patients with cervical radiculopathy, paresis or other neurological changes in the upper limb on the involved side.
4. Presence of underlying fracture associated inflammatory arthritis, known renal or hepatic disease, haematopoietic disorder and malignancy.
5. Any psychological disorder or under any psychiatry drugs.
6. Painful arc between 40° and 120° abductions indicative of rotator cuff disease
7. Uncontrolled diagnosed neurological diseases,immunodeficiency, bleeding disorders and allergies.
8. Uncontrolled medical conditions which are unfit for acupuncture.
9. Patient receiving acupuncture currently or received acupuncture 2 weeks prior to enrollment.
10. Women in lactation, pregnant women, or with plans to get pregnant in the coming half year.
11. Patients taking drugs such as NSAIDs or other pain killers.
12. Patients undergoing other trials.

4.4 Study Design

4.4.1 Type of the design - A comparative clinical trial

4.4.2 Randomization

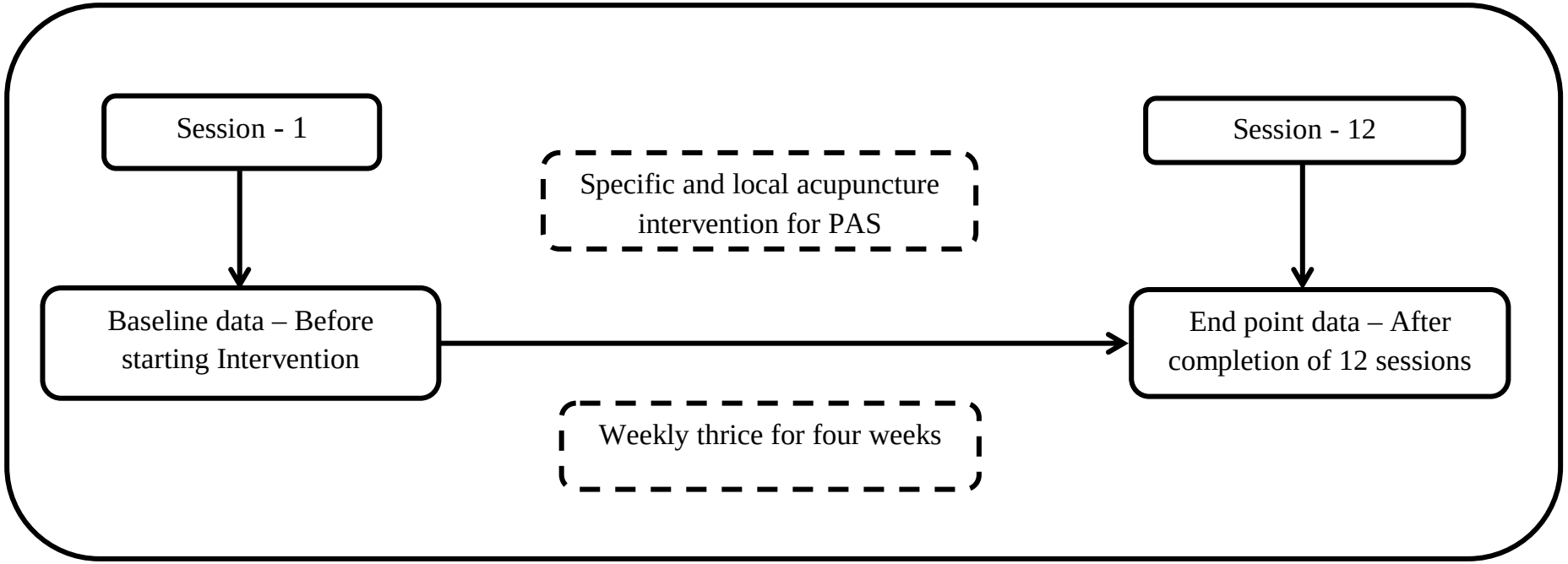
In this trial, subjects were randomly assigned to either specific or local acupuncture group. Randomization was done using the online random number generating tool at the website – www.random.org.Each random number was carefully concealed by the principle investigator, not permitted to unfold until eligible patients were included in this trial with written informed consent. After a patient was enrolled in the trial, the researcher requested patient to open one of the concealed envelopes to further assign to either specific or local acupuncture group.

Patients were not blind to the intervention. We were recruited sixty subjectswhen they were stepped into out-patient department of government yoga and naturopathy medical college and hospital, then randomly assigned to two groups i.e., specific points group(SPG), n=30 and local points group (LPG),n=30.

4.4.3 Data Points

The data was collected at baseline at day 1 (before treatment) and post data was extracted after completion of 12 sessions.Sessions was done on weekly thrice for four weeks.

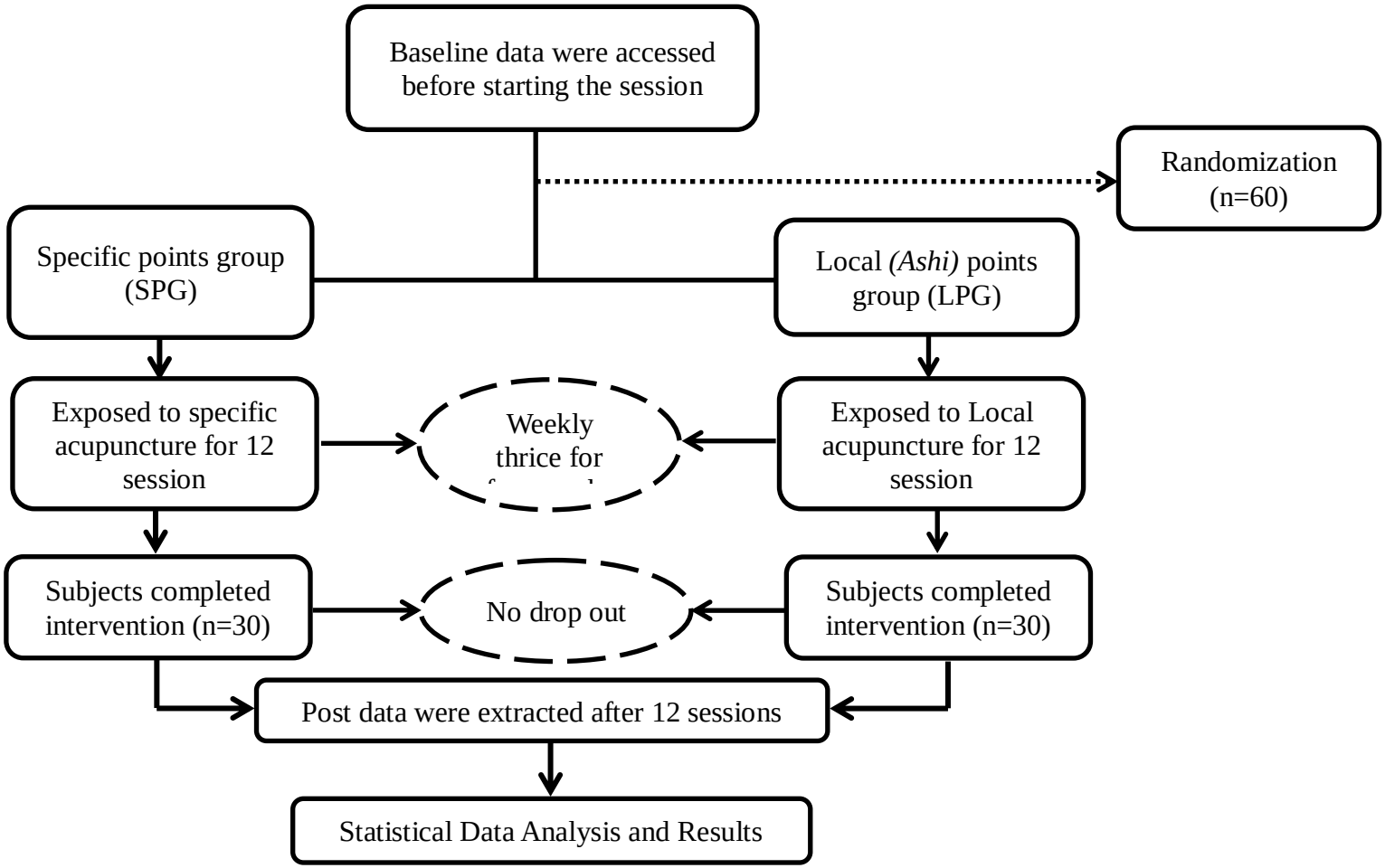
Figure 6: Illustration of Data Points



4.4.4 Trial Profile

The trail profile illustrates the study plan, flow of patients across data points, statistical analysis of data and results.

Figure 7: Trial Profile



4.5 Assessments

The baseline and post-intervention assessments consisted of:

Table 3: List of Primary and Secondary outcome variables

PRIMARY OUTCOME VARIABLES
Shoulder pain and its disability index (SPADI)
SECONDARY OUTCOME VARIABLES
Range of Motion (ROM) of Shoulder Joint i. Flexion ii. Abduction iii. External Rotation.

4.5.1 Primary Outcome Variables

4.5.1.1 Shoulder pain and its disability index (SPADI).

The Shoulder Pain and Disability Index SPADIare formulated to measure present shoulder pain and disability in an outpatient setting.It is a self-administered questionnaire that consists of 13 items that assess two domains; pain (pain symptoms, 5 items) and disability (physical function, 8 items).

The items of both domains were scored on a visual analog scale (VAS) ranging from 0 to 10, where 0 = no pain/no difficulty and 10 = worst pain imaginable/so difficult required help.**(117)** Domain scores was equally weighted, then added for a total percentage score ranging from 0 to 10, where 0 = best and 10 = worst.

Subjects were assessed twice in this study. Questionnaire was administered to the patient at the baseline after inclusion for the study and after completion of 12 sessions.

Instructions to the subjects and scoring

Subject was instructed to read the question carefully and asked them to mark circle on the score for each item that best represented their experience of their shoulder problem.**(118)** Subscale was summed and transformed to a score out of 10. Percentage was calculated out of each sub scale and also for the total score. A mean was taken of the two subscales to give a total score out of 10, higher score indicating greater impairment or disability. In each subscale patients are advised to mark only one item. If the item was not applicable to them and they are requested to pass to next question. Percentage was calculated by excluding the unanswerable item from the total score. If a patient marks more than two items that item was considered as non-applicable, no score was given.

(A SPADI questionnaire is enclosed as **Annexure III**)

4.5.2 Secondary Outcome Variables

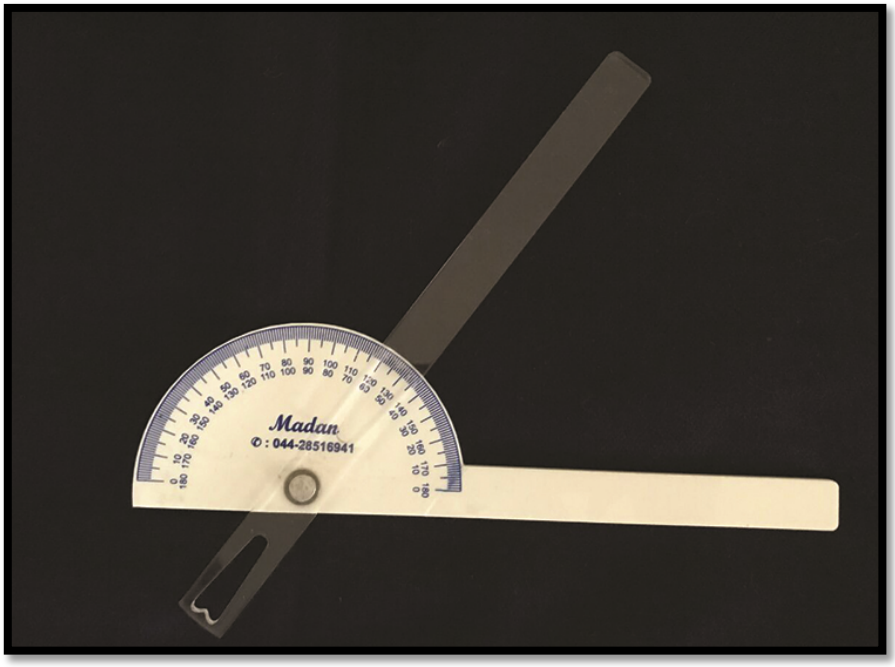
4.5.2.1 Range of Motion

Ranges of motion (ROM) measurements are essential for the evaluation and diagnosis of PAS. ROM is usually measured by using goniometer. The term goniometry is derived from two Greek words, *gonia* meaning angle and *metron*, meaning measure. Thus, a goniometer is an instrument used to measure angles.

Goniometers are produced in a variety of sizes and shapes and are usually constructed of either plastic or metal. We have used plastic goniometer for this

study. Within the field of physical therapy, goniometry is used to measure the total amount of available motion at a specific joint. Goniometry can be used to measure both active and passive range of motion.**(119)**

Figure8:Goniometer



The patient was positioned on examination table for the testing.We explained about the examination of their affected shoulder joint. Active range of motion (aROM) of flexion, abduction and external rotation was assessed at neutral position.

4.5.2.aShoulder flexion

Shoulder flexion is also referred to as forward flexion. Shoulder flexion is the motion of the shoulder when lifting the arm in front of the body over the head. Range of motion is measured with the side of the body and the arm straight. It is measured from neutral to the highest point the arm can be lifted over the head. We

have advised the patient to do active ROM without any strain. Normal range of motion is 180 degrees.

Figure 9: Examination of Shoulder flexion

Figure 10: Measuring shoulder flexion using goniometer

4.5.2.bShoulder abduction

Abduction is a term that refers to a body part moving laterally away from the body. For the shoulder joint, it refers to the arm swinging out from the side of the body, in an arm-flapping motion.

Range of motion is measured with the palm facing the side of the body and the arm held straight. It is measured from neutral and the arm hanging close to the body at the side of the thigh to the maximum point the arm can be lifted. We have instructed the subjects to lift as much they can. Normal range is 150 degrees.

Figure 11: Examination of shoulder abduction

Figure 12: Measuring of shoulder abduction using goniometer

4.5.2.cExternal Rotation

External rotation is also referred to as lateral rotation. It was measured in a neutral position with the shoulder adducted, the elbow flexed at the right angle, and the forearm parallel to the ground; the angle between the long axis of the forearm and the sagittal plane of the trunk was determined as aROM of external rotation of shoulder joint. They were measured under the instruction that subjects should move their arm as far as they could.Normal range of motion is 90 degrees.

Figure 13: Examination of shoulder external rotation

Figure 14: Measuring of shoulder external rotation using goniometer

4.6 Intervention

4.6.1 Specific Acupuncture Points

4.6.1.a ST-38 *(Tiaokou)*

Location of the point is one finger breadth lateral to the inferior (distal) end of the tibial tuberosity is ST -36 *(Zusanli)*. 5 t-sun below ST-36 and one finger breadth lateral to the anterior border of the tibia.We have inserted needle at 1 to 1.5 t-sun perpendicularly. Traditionally this point was specific acupuncture point for PAS or frozen shoulder.**(120)**

Figure 15: Location of ST-38

Figure 16: Needling of ST-38

4.6.1.bGB – 34 ***(Yanglingquan)***

Location of GB – 34 is on the antero-lateral aspect of the leg in the depression in front and below the head of the fibula or at the junction of two straight lines, one line vertically on the anterior margin of the head of fibula and other line horizontally at the neck of the fibula.**(121)**we have punctured 1.5 t-sun perpendicular to the skin; this point was the influential point for tendon and muscle.

Figure 17: Location of GB – 34

Figure 18: Needling of GB – 34

4.6.1.cGB – 41 ***(Tsulincthi)***

Location: In the depression anterior to the 4th intermetatarsal joint, in the junction of 4th and 5th metatarsal of the foot.This was the distal point for ear and breast, and one of the confluent points of the eight extra channels and also used supplementary point for PAS. Needling was 0.5 t-sun, straight.**(122)**

Figure 19: Location of GB – 41

Figure 20: Needling of GB – 41

4.6.1.dUB – 11*(Dashu)*

Location: On the upper back, 1.5 t-sun lateral to the tip of the spinous process of the 1st thoracic vertebra. This point is an influential point for bone and arthritis. Needling was 0.5 t-sun obliquely downwards.**(123)**

Figure 21: Location of UB – 11

Figure 22: Needling of UB – 11

4.6.2 Local acupuncture points

4.6.2.aLI-15 - *(Chienyu*)

Anatomical location of LI 15 is on the depression at anterio-inferior border of acromio-clavicular joint when the arm was abductedor situated in the anterior depression of the acromion on the abducted arm. Needling was done 0.5 t-sun, perpendicular.

Figure 23: Location of LI – 15

Figure 24: Needling of LI – 15

4.6.2.bTW-14 - *(Chienliao)*

It is located in between the acromion and greater tuberosity of the humerus,when the arm parallel to the floor in abducted position or when the arm is abducted two hollows appear on the shoulder. The posterior hollow is TW – 14 and the anterior hollow is LI – 15. Needling was done 1 t-sun, staright with upper arm was positioned horizontal in abduction.

Figure 25: Location of TW – 14

Figure 26: Needling of TW – 14

4.6.2.cGB – 21 *(Chienching)*

Location: Highest point of the shoulder joint. Surface marking was between the 7th intervertebral disc and acromion. Needle was inserted 0.5 t-sun, perpendicularly.

Figure 27: Location of GB – 21

Figure 28: Needling of GB – 21

4.6.2.dSI – 9 *(Chiencheng)*

Location was 1 t-sun above the lower margin of the posterior axillary fold; arm should be kept in full adduction. 0.5 t-sun, straight was inserted.

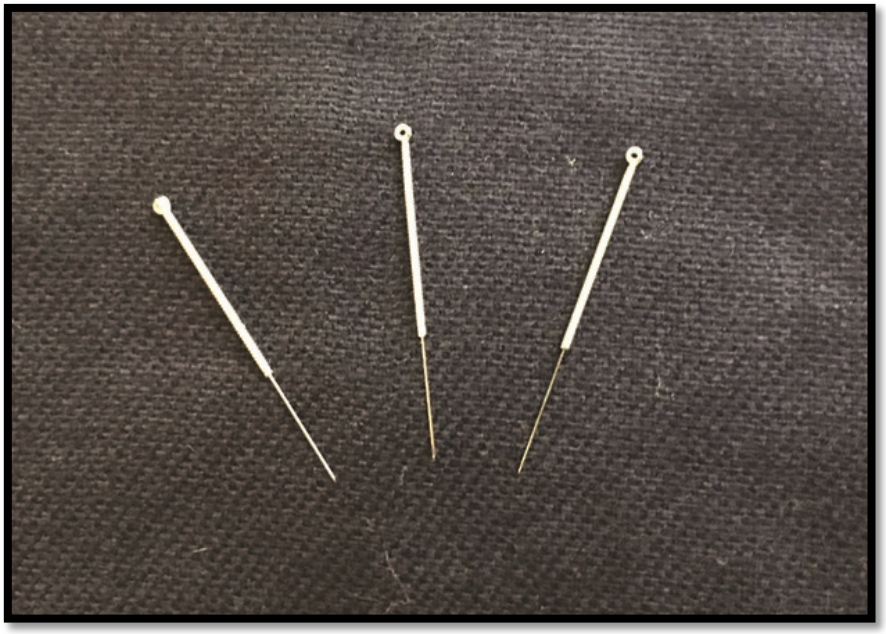
Figure 29: Location of SI – 9

Figure 30: Needling of SI – 9

4.6.3Acupuncture needles

In this study we have used 0.5 t-sun sterile needles and no needles were reused. Used needle were destroyed through electric needle destroyer.

Figure 31: Acupuncture Needles (½ t-sun)



4.7 Data extraction & analysis

4.7.1 Data Extraction:

The data was collected as primary outcomes and secondary outcome variables. The assessments were done on the before intervention starts (baseline data) and after completion of 12 session (post data). The data was organized in Microsoft Excel Sheets. (Version 2010)

4.7.2 Data Analysis:

Data were analysed using IBM SPSS 18.0. The data was checked for normality by Shapiro-Wilk test, ANOVA was used to compare means between the two groups. For all the analysis, we present 95% confidence intervals and considered $p<0.05$ as significant.

5.0 RESULTS

The present study was conducted to compare the effect of specific acupuncture points and local acupuncture points on Periarthritis of Shoulder (PAS) with primary and secondary variables viz. Shoulder pain and disability index (SPADI), Range of motion of the shoulder – flexion, abduction and external rotation. Result wascompared within and between groups, wherein data was extracted at baseline and post-intervention after 12 sessions. Within specific group data's were compared with pre and post intervention showed that significant changes *(P<0.05)* in the pain index, disability index, total SPADI score, shoulder flexion, abduction and external rotation. Local acupuncture group was also showed significant changes in the both primary and secondary variables. Paired sample test was used to find the difference within groups. When data's were compared between specific and local acupuncture group, results showed that specific acupuncture was significant in both statistically and clinically in pain index *(P<0.002)*, disability index *(P<0.009)*, total SPADI score *(P<0.003)*, shoulder flexion *(P<0.004)*, abduction *(P<0.002)* and external rotation *(P<0.04)*. ANOVA was used to find the difference between two groups.

Table 4: Results of Primary Outcome Variables

Variables	Specific Points Group (n=30)		Local Points Group (n=30)		*p* Value
	Mean ±SD		Mean ±SD		
	Pre	Post	Pre	Post	
Pain Index (%)	84.33±6.51	56.60±14.79	79.60±10.87	61.46±12.40	*0.002*
Disability Index (%)	82.70±5.94	54.20±15.75	81.41±7.92	61.62±12.45	*0.009*
Total Score (%)	83.33±5.89	55.12±15.14	80.73±8.74	61.84±12.30	*0.003*

% - Percentage, SD – Standard deviation, *p* – Probability

Figure 32: Comparison of **SPADI - Pain Index (%)** in a bar diagram.

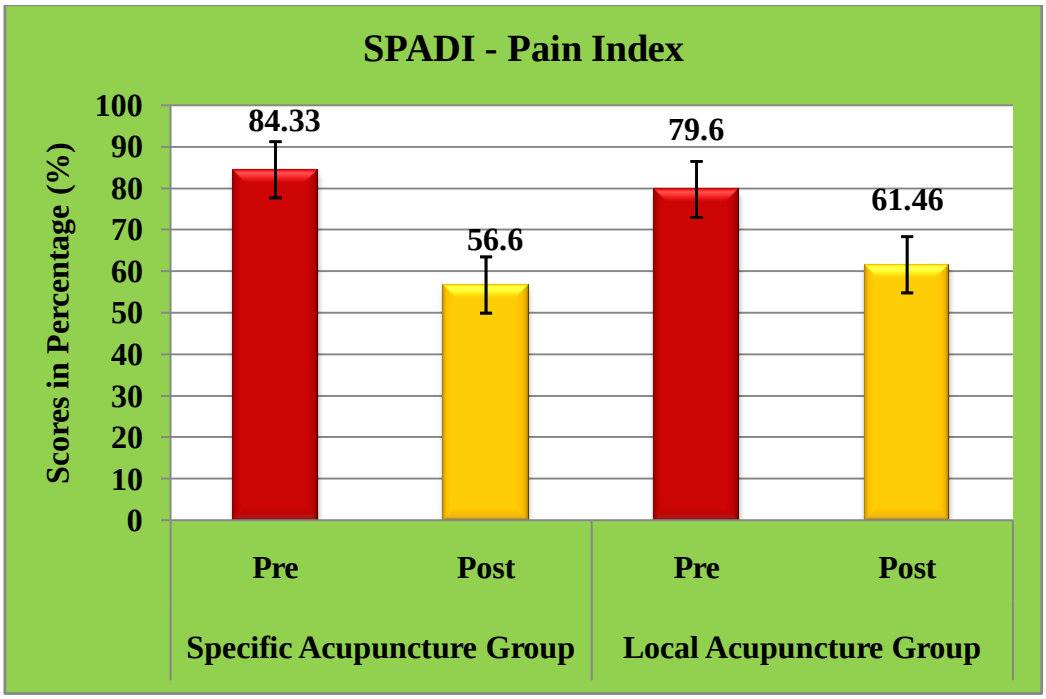


Figure 33: Comparison of **SPADI - Disability Index (%)**in a bar diagram.

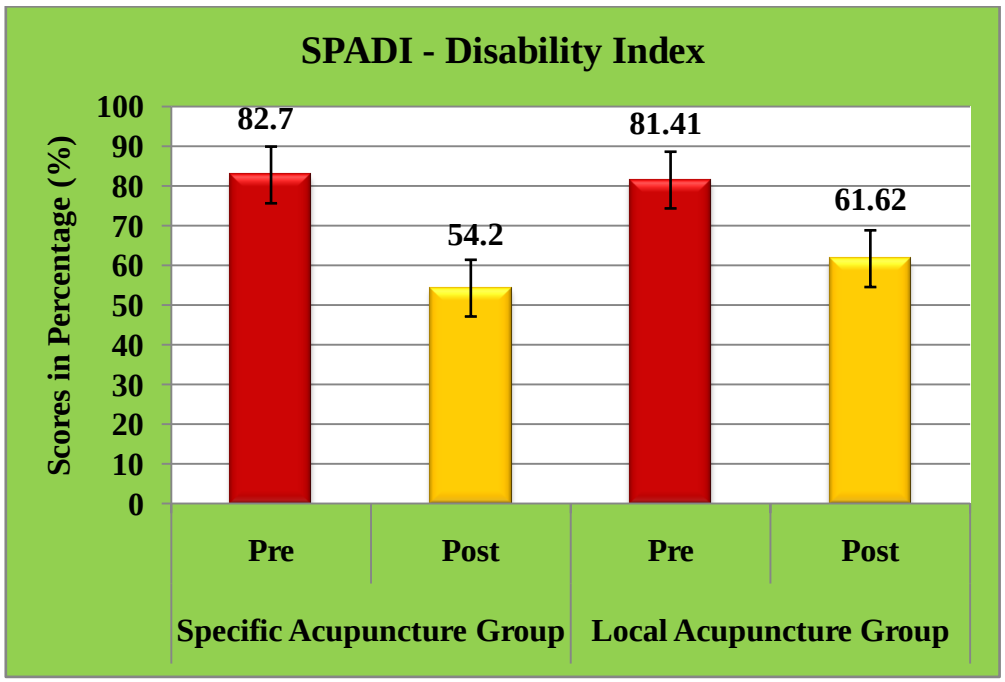


Figure 34: Comparison of **SPADI – Total Score (%)**in a bar diagram.

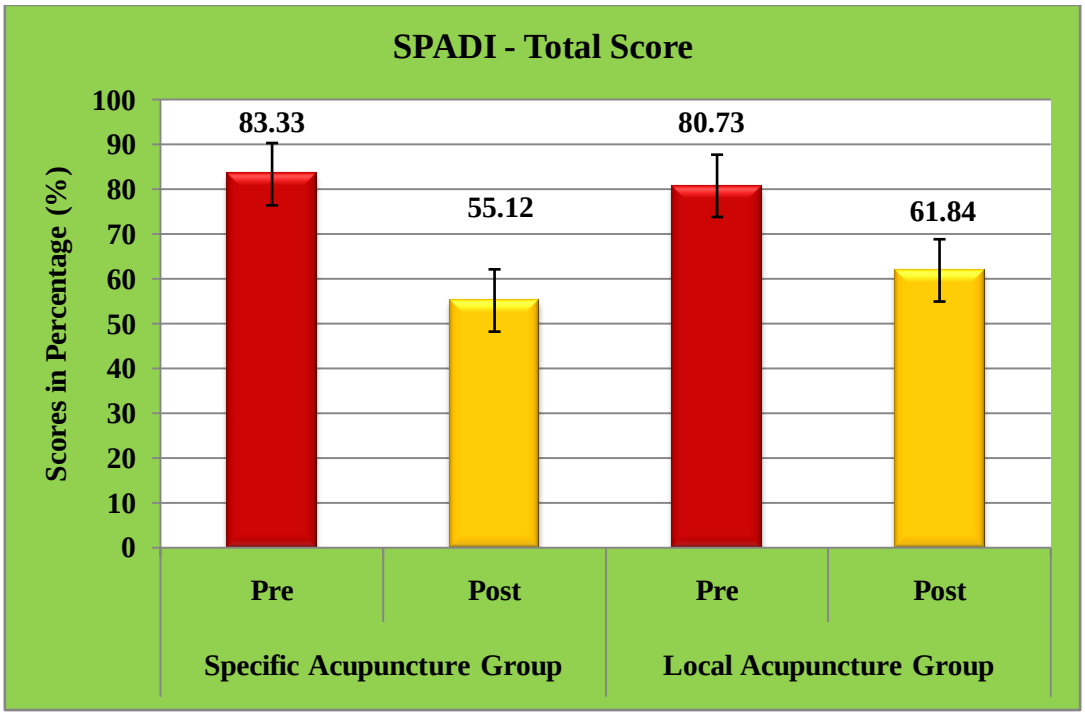


Table 5: Results of Secondary Outcome Variables

Variables	Specific Acupuncture Group (n=30)		Local Acupuncture Group(n=30)		*p* Value
	Mean ±SD		Mean ±SD		
	Pre	Post	Pre	Post	
Shoulder Flexion	81.4±5.17	116.43±18.13	80.8±5.56	104.73±15.45	0.004
Shoulder Abduction	82.4±4.75	120.06±19.88	78.73±5.58	103±16.48	0.002
Shoulder External Rotation	26.48±2.47	42.63±4.71	25.3±4.53	38.93±6.43	0.04

% - Percentage, SD – Standard deviation, *p* – Probability

Figure 35: Comparison of **Shoulder Flexion**in a bar diagram.

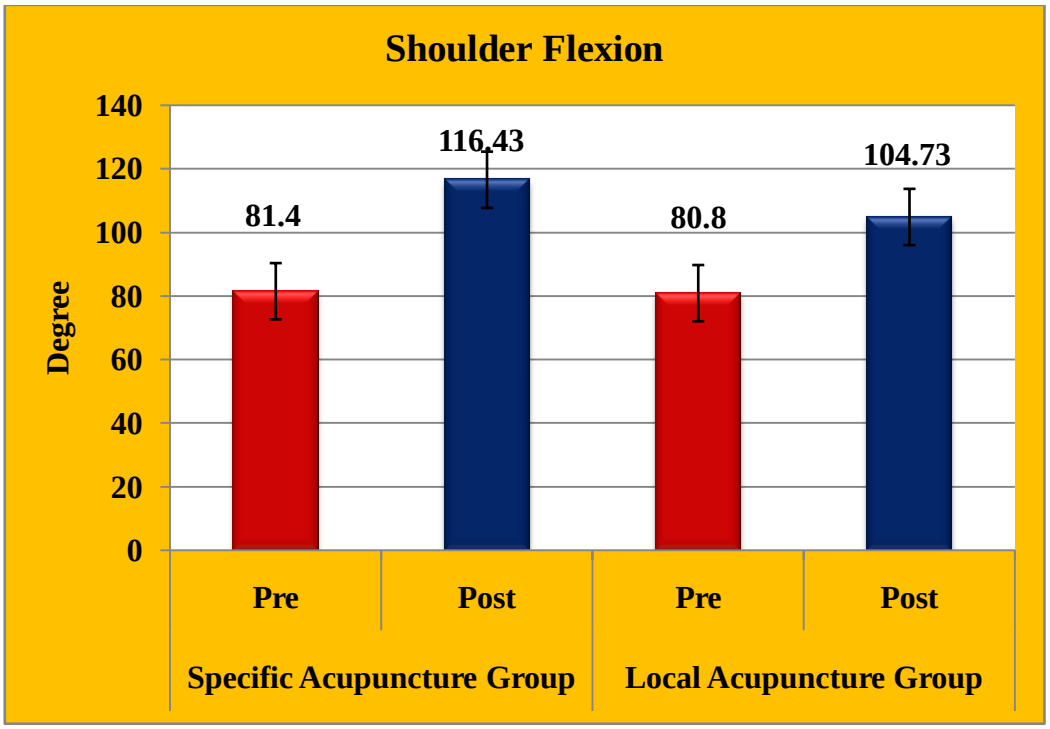


Figure 36: Comparison of **Shoulder Abduction** in a bar diagram.

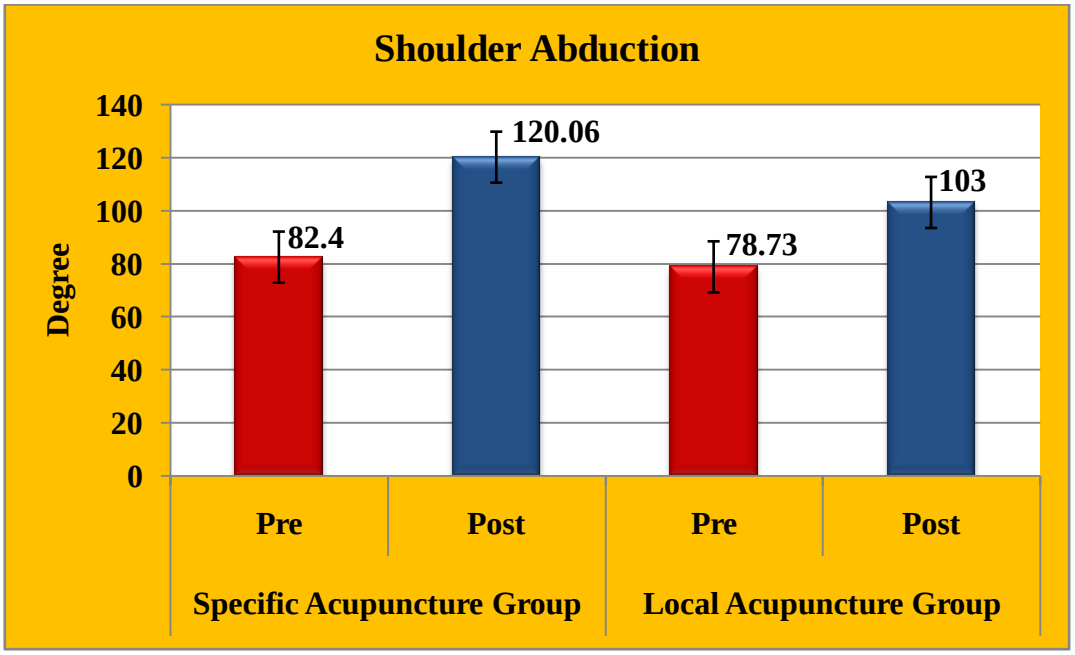
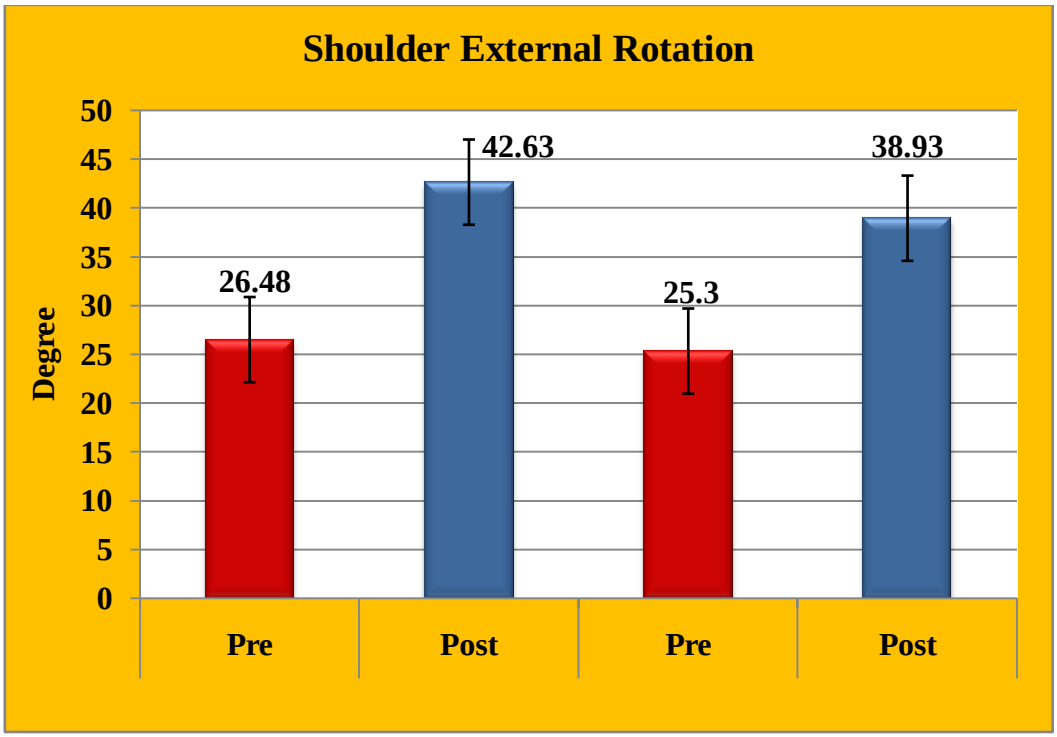


Figure 37: Comparison of **Shoulder External Rotation**in a bar diagram.



6.0 DISCUSSION

Acupuncture is a complementary and alternative therapy has been increasingly recognized in western countries. Current evidence suggests that acupuncture is a valid intervention for treating pain and musculoskeletal disorders.In this study we have used specific or distal acupuncture points and local or ashi acupuncture points as an intervention. SPADI questionnaire and ROM – flexion, abduction and external rotation are the variables used to measure the pain, disability and restriction of shoulder joint.

The result of this study revealed that both specific acupuncture and local acupuncture may alleviate the symptoms of Periarthritis of shoulder in pain and disability index and also in the range of motion of flexion, abduction and external rotation. However specific acupuncture points ST-38 *(Tiaokou),* GB – 34 *(Yanglingquan),* GB – 41 *(Tsulincthi),* UB-11*(Dashu)* shows significant result when compared to that of local*(Ashi)* acupuncture points LI – 15 *(chienyu*), TW – 14 *(chienliao),* SI – 9 *(Chienchen),* GB – 21*(Jianjina)*for 12 sessions.

Systemic review of *green et al***(105)** says that no adverse effect was noticed, in this study also observed that no subjects were had any adverse changes during the 12 sessions on sixty subjects. This study has no drop out. Subjects were compliance to the intervention. *Chen et al***(106)**in 2006 shows that both normal acupuncture and shallow needling with short needle was clinically benefited and there was no significant changes between the two groups, whereas in the present study we were noticed that specific acupuncture was beneficial for the

management of shoulder pain and disability than the local acupuncture group. There was also significant changes have been observed in within the both group.

A RCT on three phase acupuncture and routine acupuncture showed that three phase acupuncture may have therapeutic effect than the regular or local acupuncture.**(107)** Same has been noticed in this study that specific acupuncture may have high therapeutic value in both clinically and statistically when compared to local acupuncture. The transient therapeutic effect of *fu*-needle showed significant changes on articular mobility, soft tissue pain self-rating score and self-rating score of shoulder tenderness. Except stabbing times, degree at scattering, retaining the needle and bleeding times in withdrawing the needle when compared to routine acupuncture.**(108)** However in our study shows specific acupuncture was effective in management of pain and disability index and range of motion of shoulder on PAS subjects.

Previous study on comparison between traditional, standard, sham acupuncture on SPADI showed that clinical improvements was noticed in the both individualized or traditional acupuncture points and standard acupuncture, our study results also showed that total SPADI score was improved in both specific and local acupuncture group. But specific acupuncture points were noticed marked improvement in the total SPADI score.**(109)** Another multi-centric study shows that acupuncture may help to alleviate the symptoms of PAS than the conservative orthopedic treatment.**(110)** Our study also shows that symptoms of PAS like pain, restricted movements were improved after 12 session of acupuncture for 4 weeks.

Han z et al, in 2014 observed that combined therapy of local acupuncture, warm needling and positive functional exercise may be benefited for acute stage of PAS and combined therapy of local acupuncture and distal acupuncture with filiform and warm needling and positive functional exercise could be beneficial for chronic stages of PAS.**(111)** In our study we have included both acute (Painful) and chronic (frozen) stages of PAS. We have find that any stages of PAS could get improvement in ROM and pain by adopting specific acupuncture.

One more study has concluded that abdominal acupuncture(CV 12, K 17, ST 24) show significant changes in both pain and adhesion stages of PAS.**(112)**In our study we have included both acute (Painful) and chronic (frozen) stages of PAS. We have find that any stages of PAS could get improvement in ROM and pain by adopting specific acupuncture. A randomized controlled trial was conducted to find the efficacy of sharp-hook acupuncture. They have concluded that sharp-hook acupuncture helps to relieve the pain and restore the shoulder function for patients with PAS.**(114)** Both in our study and shark-hook acupuncture study also advised intervention for 4 weeks, and noticed significant changes in the outcome variables. Another research study observed that integrating acupuncture with conservative therapy showed superior effectiveness compared with conservative therapy alone.**(115)**

There was different types of needling techniques were used to intervenePeriarthritis of shoulder on various number of sessions and duration; no adverse effect was noticed in the previous studies. However, in this study both specific acupuncture points (ST-38, GB-34, GB-41, and UB-11) and local

acupuncture points (LI-15, TW-14, SI-9, GB-21) shows changes within the groups, but when compared with each group specific acupuncture points shows significant changes in the management of Periarthritis of shoulder.

6.1 Limitations

a) The sample size was relatively smaller.

b) There was no follow-up in this study.

c) Room temperature was not maintained equally to all subjects during treatment.

d) Diurnal variations might have influenced the results.

e) Other physical activities and diet in home might acted as confounding factors for this study.

f) Mechanism of specific acupuncture points in the management of pain, disability and ROM of shoulder still inconclusive.

6.2 Directions for future research

a) This study should replicate with lager sample size.

b) A randomized controlled trial with multi arm study could be better for definite conclusion.

c) Strong methodology with follow-up is essential to support our result.

d) Objective variables like digital goniometer; bio-markers for the pain can be used.

e) Mechanism of specific acupuncture points should be evaluated in depth.

7.0 CONCLUSION

The present study shows that both specific and local acupuncture points may have similar effect in management of shoulder pain and its restriction which was measured through SPADI and range of motion – flexion, abduction and external rotation. Specific acupuncture points showed higher therapeutic benefits on patients with PAS, when compared to local acupuncture points. Further research with a larger sample size, objective variables and randomized controlled trial is warranted to reveal accurate changes in this field.

8.0 SUMMARY

Inception of this study was keeping in mind of the fact that PAS is major musculoskeletal disability which burdens the patient with day-to-day life activity. PAS affects 2%-3% in general population and 20% of diabetic patients.PAS can cause painful and prolonged immobilization of shoulderwith decreased collagen length, fibro fatty infiltration into the capsular recess, ligament atrophy resulting in decreased stress absorption, collagen band bridging across recesses, random collagen production, and altered sarcomere number in muscle tissue

Acupuncture is a complementary and alternative therapy has been increasingly recognized in western countries. Current evidence suggests that acupuncture is a valid intervention for treating pain and musculoskeletal disorders.

In this study we have used specific or distal acupuncture points and local or ashi acupuncture points as an intervention. SPADI questionnaire and ROM – flexion, abduction and external rotation are the variables used to measure the pain, disability and restriction of shoulder joint.

Sixty subjects were randomly assigned into specific points group (SPG, n=30) and local points group (LPG, n=30). Both groups were assessed at baseline and at the end of 12 sessions for Shoulder pain and its disability index (SPADI) and the range of motion (ROM). Intervention was weekly thrice on alternate days for four weeks. Sterile needles were placed on the particular points for 20 min. Specific points are ST-38, GB – 34, GB – 41, UB -11 and Local points are LI – 15, TW – 14,SI – 9, GB – 21.Both specific and local group’s shows improvements within the group in total SPADI score and ROM. But Specific acupuncture shows

significant changes in both statistically and clinically in pain index, disability index, total SPADI score, shoulder flexion, abduction and external rotation. Overall acupuncture can be used as management of shoulder pain and restriction of shoulder joint with cost effective and without any side effects.

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10.0 ANNEXURES

ANNEXURE – I

INFORMED CONSENT FORM

Government Yoga and Naturopathy Medical College & Hospital, Arumbakkam, Chennai.

Participant's Name: ----------

Title of Study	"A Comparative Study of Local and Specific Acupuncture Points on Periarthritis of Shoulder"
Researcher	**Dr.A.Naveena,** M.D in A & EM , Department of Acupuncture and Energy Medicine, Govt. Yoga and Naturopathy medical college, Chennai.

I have been invited to participate in the research of**"A Comparative Study of Local and Specific Acupuncture Points on Periarthritis of Shoulder"** I understand that it will involve the practice of puncturing with sterile needles, which may be useful for my well-being.

I have been informed that there will be pre and post assessments where non-invasive methods will be used to measure range of motion using goniometer and SPADI questionnaire.

I am aware that there may be no benefit to me personally and that I will not be compensated whatsoever.

I had given the opportunity to ask questions about the study and the questions what I asked have been answered to my satisfaction.

I understand that I have the right to withdraw from the research at any time without affecting my medical care or legal rights.

Hereby, I confirm that I have understood the above study.I myself consciously give consent to participant in this study.

Date : **Signature:** _____

I have accurately read or witnessed the accurate reading of the consent form to the potential participant, and the individual has given opportunity to ask questions. I confirm that the individual has given consent consciously.

Researcher :

Date : **Signature:** _____

ANNEXURE – II

CASE SHEET

Name: **Age:**

Sex: **OP No:**

Group & Participant No:

Chief Complaints:

History of Present Complaints:

Past History:

Provisional Diagnosis:

Variables

SPADI

Pain Scale	Pre -	Post -
Disability	Pre -	Post -

Range of Motion

Flexion of Shoulder	Pre -	Post -
Abduction	Pre -	Post -
External Rotation	Pre -	Post -

ANNEXURE – III

SHOULDER PAIN AND ITS DISABILITY INDEX (SPADI) QUESTIONNAIRE

Name: _____ Date: _____

Instructions:
Please answer the following questions by writing a number from 0-10 in the blank provided. If you feel a questions does not pertain to you please put a NA (not applicable) i the space. We will ask you to repeat this index in order to help our facility keep track of our treatment outcomes.

Pain scale: On a scale of 0-10, How severe is your pain: **0 = "no pain at all"----------10 = "worst pain imaginable"**	
1. At its worst?	
2. When lying on the involved side?	
3. Reaching for something on a high shelf?	
4. Touching the back of your neck?	
5. Pushing with the involved arm	
Disability scale: On a scale of 0-10, How much difficulty do you have: **0 = "no difficulty"----------10 = "so difficult it required help"**	
1. Washing your hair?	
2. Washing your back?	
3. Putting on an undershirt or pullover sweater?	
4. Putting on a shirt that buttons down the front?	
5. Putting on your pants?	
6. Placing on object on a high shelf?	
7. Carrying a heavy object of 10 pounds?	
8. Removing something form your back pocket?	

To be completed by office staff:
Circle one: Initial / Re-eval / Discharge
Diagnosis: _____Total # of treatments: ____

Pain Scale Score: _____ **Disability Scale Score:**	**Total Score: _____**

[Scoring: Summate the scores and divide by the highest score possible (130 if all questions answered). If an item is deemed not applicable, no score is calculated. Multiply the total score b 100.]

Roach KE, Budiman-Mak E, Songsirdej N, Lertratanakul Y. Development of a shoulder pain and disability index Arthritis Care Res 1991;4:143-9.
Source: Adapted from: Lewis C, Wilk, Wright R. The Orthopedic Outcomes Tool Box.
Virginia: Learn Publications.